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(71)Applicant : CANON INC

(72)Inventor : UMIBE NORIYUKI
KOBAYASHI ISAO
TAKEDA SHINICHI
MIZUTANI HIDEMASA
ITABASHI SATORU

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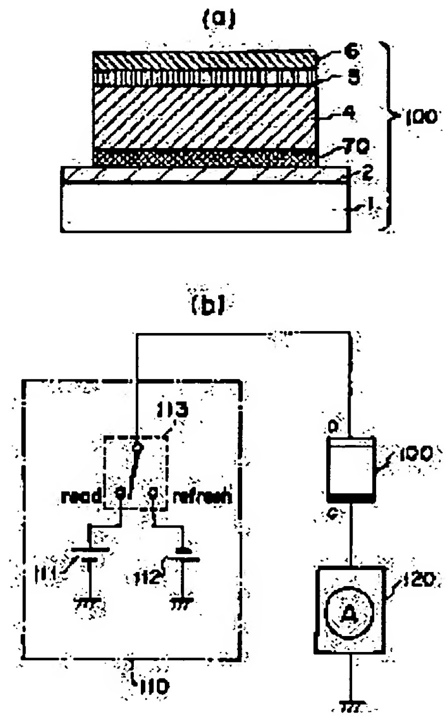
(54) PHOTOELECTRIC CONVERSION DEVICE, ITS DRIVING METHOD AND SYSTEM HAVING THAT DEVICE

(57)Abstract:
PURPOSE: To realize a photoelectric conversion device, which has a high S/N ratio, is low in cost, in easy in production and is stable in characteristics, a method of driving the device and a system having the device.
CONSTITUTION: A photoelectric conversion device has a photoelectric conversion part 100 formed by depositing in order a first electrode layer 2, an insulating layer 70 for stopping a carrier transfer, a non-single crystal photoelectric conversion semiconductor layer 4, an injection stopping layer 5 for stopping an injection of first conductivity type carriers in the semiconductor layer and a second electrode layer 6.



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CLAIMS

[Claim(s)]
[Claim 1] The photoelectrical inverter characterized by having the photoelectrical transducer which has the pouring blocking layer and the second electrode layer which prevent pouring of the carrier of the first mold of the above to the insulating layer which prevents passage of the carrier of both carriers of the second mold with which positive/negative differs from the first electrode layer, the carrier of the first mold, and the carrier of the first mold of the above on an insulating substrate, a photo-electric-translation semiconductor layer, and this semiconductor layer.
[Claim 2] In the aforementioned refreshment mode, electric field are impressed in the direction which leads the carrier of the first mold of the above to the electrode layer of the above second from the aforementioned semiconductor layer at each class of the aforementioned photoelectrical transducer. in a photoelectrical translation mode The power supply section for impressing electric field in the direction which the carrier of the first mold of the above generated by the light which carried out incidence to the aforementioned semiconductor layer is stopped in the aforementioned semiconductor layer, and leads the carrier of the second mold of the above to the electrode layer of the above second at each class of the aforementioned photoelectrical transducer, The photoelectrical inverter according to claim 1 which has further the detecting element which detects the carrier of the second mold led to the carrier of the first mold of the above accumulated by the aforementioned photoelectrical translation mode at the aforementioned semiconductor layer, or the electrode layer of the above second.
[Claim 3] The photoelectrical inverter according to claim 1 in which at least one of the aforementioned first and the second electrode has a transparent conductive layer.
[Claim 4] The photoelectrical inverter according to claim 1 in which the aforementioned semiconductor layer has a hydrogenation amorphous silicon.
[Claim 5] The aforementioned pouring blocking layer is a photoelectrical inverter according to claim 1 which is the semiconductor layer which doped n type or the p type element.
[Claim 6] The aforementioned pouring blocking layer is a photoelectrical inverter according to claim 1 which is the barrier layer produced from the difference of the work function of the second electrode of the above, and the aforementioned semiconductor layer.
[Claim 7] The photoelectrical inverter according to claim 1 which has a switching device on the aforementioned substrate.
[Claim 8] The aforementioned switching device is a photoelectrical inverter according to claim 7 which is the transistor which has the 1st and 2nd main-electrode layers which opened the gap in a gate electrode, the 2nd insulating layer, the 2nd semiconductor layer, and the 2nd semiconductor layer, and were prepared through the ohmic-contact layer.
[Claim 9] The gate electrode of the aforementioned switching device, the 2nd insulating layer, the 2nd semiconductor layer, an ohmic-contact layer, the 1st, and 2nd main-electrode layers are photoelectrical inverters according to claim 8 the 1st electrode layer of a photoelectrical transducer, an insulating layer, a semiconductor layer, a pouring blocking layer, and whose 2nd electrode layer are common layers, respectively.

[Claim 10] The semiconductor layer of the above 2nd is a photoelectrical inverter according to claim 8 which has a hydrogenation amorphous silicon.
[Claim 11] Furthermore, the photoelectrical inverter according to claim 7 which has capacitative element.
[Claim 12] The aforementioned capacitative element is a photoelectrical inverter according to claim 11 which has the 3rd insulating layer prepared between the 3rd electrode layer, the 4th electrode layer, the 3rd, and 4th electrode layers.
[Claim 13] The photoelectrical inverter according to claim 8 which has further the capacitative element which has the 3rd insulating layer prepared between the electrode layer of the above 3rd, the 4th electrode layer, and the 3rd and 4th electrode layer.
[Claim 14] The aforementioned capacitative element is a photoelectrical inverter according to claim 11 which accumulates the electrical signal based on the optical information by which photo electric translation was carried out in the photoelectrical transducer.
[Claim 15] The 3rd electrode layer of the aforementioned capacitative element, the 3rd insulating layer, the 4th electrode layer, the 1st electrode layer of the aforementioned photoelectrical transducer, an insulating layer, and the 2nd electrode layer are a photoelectrical inverter according to claim 11 which is a common layer, respectively.
[Claim 16] The 3rd electrode layer of the aforementioned capacitative element, the 3rd insulating layer, the 4th electrode layer, the 1st electrode layer of a photoelectrical transducer, an insulating layer, and the 2nd electrode layer are a photoelectrical inverter according to claim 13 which is a common layer, respectively.
[Claim 17] The aforementioned photoelectrical transducer is a photoelectrical inverter according to claim 1 which it has.
[Claim 18] The aforementioned photoelectrical transducer is a photoelectrical inverter according to claim 17 allotted to-dimensional [1] or two-dimensional.
[Claim 19] Each of the aforementioned photoelectrical transducer is a photoelectrical inverter according to claim 17 which has a switching device.
[Claim 20] The aforementioned photoelectrical transducer is a photoelectrical inverter according to claim 19 by which connects in common, and blocks by the number of desired, and operation of the aforementioned switching device is enabled for every block.
[Claim 21] The photoelectrical inverter according to claim 20 which has the matrix signal wiring for outputting the signal from two or more optoelectric transducers divided into two or more aforementioned blocks.
[Claim 22] The aforementioned matrix signal wiring is a photoelectrical inverter according to claim 21 which has the interlayer prepared between the 5th electrode layer, the 6th electrode layer, and the 5th and 6th electrode layer in the intersection.
[Claim 23] The aforementioned interlayer is a photoelectrical inverter according to claim 22 which has the 4th insulating layer.
[Claim 24] The aforementioned interlayer is a photoelectrical inverter according to claim 22 in which it has the 4th insulating layer and the electrode layer of the above 5th, the 4th insulating layer, the 6th electrode layer and the 1st electrode layer of a photoelectrical transducer, an insulating layer, and the 2nd electrode layer have a common layer.
[Claim 25] The photoelectrical inverter according to claim 1 which has a refreshment means to impress a pulse voltage through the capacitative element for pulse impression, and to impress electric field to the aforementioned photoelectrical transducer.
[Claim 26] The lamination of the aforementioned capacitative element for pulse impression is the same photoelectrical inverter according to claim 25 as the aforementioned photoelectrical transducer.
[Claim 27] The system characterized by providing the following. a substrate top -- the 1st electrode layer and the 2nd electrode layer -- this -- the plurality of the photoelectrical transducer which has the pouring blocking layer which prevents pouring of the carrier of the 1st mold of the above to the insulating layer, the semiconductor layer, and this semiconductor layer which prevent passage of the

carrier of the 2nd different mold from the carrier of the 1st mold and this carrier which were formed between the 1st and 2nd electrode layers A signal-processing means to process the signal from this photoelectrical transducer.
[Claim 28] Furthermore, the system according to claim 27 which has a record means for recording the signal from the aforementioned signal-processing means.
[Claim 29] Furthermore, the system according to claim 27 which has a display means for displaying the signal from the aforementioned signal-processing means.
[Claim 30] Furthermore, the system according to claim 27 which has a transmission means for transmitting the signal from the aforementioned signal-processing means.
[Claim 31] The aforementioned photoelectrical inverter is a system according to claim 27 which has a fluorescent substance.
[Claim 32] The system according to claim 27 which has the light source for generating the optical information inputted into the aforementioned photoelectrical inverter.
[Claim 33] The aforementioned light source is a system according to claim 32 which emits an X-ray.
[Claim 34] The insulating layer which prevents passage of both carriers of the 2nd mold with which positive/negative differs from the 1st electrode layer, the carrier of the 1st mold, and the carrier of the 1st mold of the above on a substrate, It is the method of driving the photoelectrical transducer which has the 2nd electrode layer prepared through the pouring blocking layer which prevents the carrier of the 1st mold of the above being poured in into the semiconductor layer and this semiconductor layer. This drive method has refreshment mode and a photoelectrical translation mode, and sets them in the aforementioned refreshment mode. The electric field which lead the carrier of the 1st mold of the above to the electrode layer of the above 2nd from the aforementioned semiconductor layer are impressed. in the aforementioned photoelectrical translation mode The drive method of the photoelectrical inverter characterized by impressing electric field in the direction which the carrier of the 1st mold of the above generated by the light which carried out incidence to the aforementioned semiconductor is stopped in the aforementioned semiconductor layer, and leads the carrier of the 2nd mold of the above to the electrode layer of the above 2nd.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the system which has the possible single dimension of performing actual size reading of facsimile, a digital copier, or X-ray image pck-up equipment or a 2-dimensional photoelectrical inverter, its drive method, and it with respect to the system which has a photoelectrical inverter, its drive method, and it.
[0002]
[Description of the Prior Art]
[Related Art] -- as reading systems, such as facsimile, a digital copier, or X-ray image pck-up equipment, reduction optical system and the CCD type sensor were used conventionally -- it read and the system was used However, development of the so-called stuck type sensor which forms an optoelectric transducer and the signal-processing section in the substrate of a large area, and is read with the optical system of the information source and actual size progresses by development of the photo-electric-translation semiconductor material represented by the hydrogenation amorphous silicon (it is hereafter described as a-Si), and in recent years is being put in practical use or taken. Only as a photo-electric-translation material, since especially a-Si can be used also as a semiconductor material of a thin film electric field effect type transistor (it is described as Following TFT), it can form simultaneously a photo-electric-translation semiconductor layer and the semiconductor layer of TFT, and is convenient.
[0003] Drawing 4 (a) and drawing 4 (b) are the typical cross sections for explaining an example of the composition of the conventional photosensor, respectively, and drawing 4 (a) and drawing 4 (b) show an example of the lamination of a photosensor, respectively, drawing 4 (c) is a rough circuit diagram for explaining the drive method, and they show an example of the typical drive method common to drawing 4 (a) and drawing 4 (b). It is the photosensor of a photo-diode type [drawing 4 / (b) / drawing 4 (a) and], and drawing 4 (a) is called a PIN type and drawing 4 (b) is called the Schottky type. For a lower electrode and 3, as for an intrinsic-semiconductor layer (it is described as i layers below), and 5, a p type semiconductor layer (it is described as p layers below) and 4 are [one in drawing 4 (a) drawing 4 (b) / an insulating substrate and 2 / a n-type-semiconductor layer (it is described as n layers below) and 6] transparent electrodes. In the Schottky type of drawing 4 (b), the material of the lower electrode 2 is chosen suitably, and the Schottky barrier layer is formed so that i layers of unnecessary electrons may not be poured into 4 from the lower electrode 2.
[0004] In drawing 4 (c), 10 shows the photosensor which symbolized and expressed the above-mentioned photosensor, 11 shows the power supply and 12 shows detecting elements, such as current amplifier. The direction where the direction shown in [C] the photosensor 10 was shown by A the transparent-electrode 6 side in drawing 4 (a) and drawing 4 (b) is the lower electrode 2 side, and the power supply 11 is set up so that positive voltage may join the C side to the A side. Operation is explained briefly here.
[0005] If incidence of the light is carried out from the direction shown by the arrow and i layers are given to 4 as shown in drawing 4 (a) and drawing 4 (b), light will be absorbed and an electron and a hole

will generate it. Since i layers of electric fields are impressed to 4 by the power supply 11, an electron passes n layer 5 the C side that is, and moves to a transparent electrode 6, and a hole is moved to the A side 2, i.e., a lower electrode. Therefore, it means that the photocurrent had flowed to the photosensor 10. When light does not carry out incidence, neither an electron nor a hole is generated in 4 i layers. moreover, again 5 commits n layers of holes of six in a transparent electrode as a pouring blocking layer of a hole, with the PIN type of drawing 4 (a), with the Schottky type of drawing 4 (b), in the electron in the lower electrode 2, a Schottky barrier layer works as an electronic pouring blocking layer, 3 cannot move in p layers of electrons and holes, and current does not flow. Thus, the current which flows a circuit by the existence of the incidence of light changes. If this is detected by the detecting element 12 of drawing 4 (c), it will operate as a photosensor.

[0006]

[Problem(s) to be Solved by the Invention] However, an SN ratio is high at the above-mentioned conventional photosensor, and it is difficult to produce the photoelectrical inverter of a low cost. The reason is explained below.

[0007] The first reason has both the PIN type of drawing 4 (a), and the Schottky type of drawing 4 (b) in the place which needs two pouring blocking layers.

[0008] In the PIN type of drawing 4 (a), n layers of properties which prevent that a hole pours [which is a pouring blocking layer] i layers into 4 are required for it at the same time 5 leads an electron to a transparent electrode 6. If one of properties are missed, a photocurrent will fall, or current (it is described as the dark current below) in case light does not carry out incidence will occur and increase, and causes [of an SN ratio] a fall. Even if this dark current carries out processing which is called shot noise and which swings, contains the so-called quantum noise and deducts the dark current by the detecting element 12 even if at the same time itself is considered to be a noise, it cannot make the quantum noise accompanying the dark current small.

[0009] Usually, in order to raise this property, it is necessary to attain i layers of optimization of 4, the conditions of membrane formation of n layer 5, and the conditions of annealing after creation. However, although an electron and a hole are reverse also about p layer 3 which is another pouring blocking layer, an equivalent property is required, and each conditions need to be optimized similarly. Usually, the conditions of optimization of n layers of former and optimization of p layers of latters are not the same, and it is difficult to satisfy both conditions simultaneously.

[0010] That is, that two pouring blocking layers are required in the same photosensor makes formation of the photosensor of a high SN ratio difficult.

[0011] This is the same also in the Schottky type of drawing 4 (b). Moreover, although the Schottky barrier layer is used for one of the two's pouring blocking layer in the Schottky type of drawing 4 (b), it is still more difficult for this to use i layers of differences of the work function of 4 with the lower electrode 2, and to limit the material of the lower electrode 2, or for the influence of the localized level of an interface to influence a property greatly, and to satisfy conditions.

[0012] Furthermore, although forming i layers of the oxide films of the thin silicon metallurgy group around 100A and nitrides between 4 with the lower electrode 2 is also reported in order to raise the property of a Schottky barrier layer Since this uses the tunnel effect, leads a hole to the lower electrode 2, and raises the electronic effect which prevents i layers of pourings to 4 and the difference of a work function is used too, the material of the lower electrode 2 needs to be limited. In addition, in order to use the reverse property of prevention of electronic pouring, and movement of the hole by the tunnel effect, it is required that an oxide film and a nitride should be made very thin 100A order. And as for the thickness and membraneous control, productivity falls difficultly.

[0013] Moreover, that two pouring blocking layers are required becomes the factor which it not only reduces productivity, but raises cost. This is because the desired property as a photosensor is not acquired when at least one defect arises [a pouring blocking layer] with dust etc. among property overlay important point hatchet two places.

[0014] The second reason is explained using drawing 2 . Drawing 2 shows the lamination of the field effect transistor (TFT) formed by the semiconductor film of a thin film. TFT may be used as a part of

control section, when forming a photoelectrical inverter. The jack per line has shown the same thing as drawing 4 in drawing. In drawing 2 , 7 is a gate insulator layer and 60 is an up electrode. Order is explained for the forming method later on. On an insulating substrate 1, the lower electrode 2 which works as a gate electrode (G), and the up 7 or i layer electrode 60 which works as 5, the source, and drain electrodes (S, D) 4 or n layers of gate insulator layers are formed one by one, the up electrode 60 is **********ed, the source and a drain electrode are formed, n layers ********** 5 after that, and the channel section is constituted. i layers of properties of TFT are as sensitive to the state of the interface of 4 as the gate insulator layer 7, and in order to usually prevent the contamination, they are deposited on continuation within the same vacuum.

[0015] When forming the conventional photosensor on the same substrate as this TFT, this lamination poses a problem and causes a cost rise and the fall of a property. This reason is that both lamination differs to being the composition of [composition / of the conventional photosensor / which was shown in drawing 4 / type / PIN / of drawing 4 (a)] an electrode / i layer/n layer / electrode in an electrode / p layer / i layer/n layer / electrode, and the Schottky type of drawing 4 (b) with composition called in TFT an electrode / insulator layer / i layer/n layer / electrode. This shows that a photosensor and TFT cannot be simultaneously formed in the same process, and it causes the fall of the yield by complication of the process by which a FOTORISO process etc. is repeated, and a cost rise in order to form a layer required for a required place. Moreover, for communaliz(ing), i layers of interfaces of 4 are polluted by communalizing an i layer [/n] layer by etching of a gate insulator layer with the gate insulator layer 7 of the pouring blocking layer which are the gate insulating layer 7 and an important layer of a photosensor which p layers of etching processes of 3 were needed, and was described previously where TFT is important in the ability of 4 not forming membranes within the same vacuum with 3, and it becomes degradation of a property, and the cause of a fall of

[0016] Moreover, although the order of film composition of the lower electrode 2 and the thing in which i layers of oxide films and nitrides were formed between 4 is the same in order to improve the Schottky type characteristic of drawing 4 (b) mentioned above, as stated previously, an oxide film and a nitride need to be before and after 100A, and it is difficult [it] to use with a gate insulator layer in common. The result in which we experimented on drawing 3 about the yield of a gate insulator layer and TFT is shown. As for the yield, gate insulation thickness fell rapidly by 1000A or less, by 500A, the yield has not been checked about 30% in 800A, and even operation of TFT has not checked [250A] the yield 0%. It is clearly difficult to common-use-ize the oxide film of the photosensor using the tunnel effect, a nitride, and the gate insulator layer of TFT which must insulate an electron and a hole, and data show this.

[0017] Furthermore, although not illustrated, it is difficult for leak to make a few good property thing from the same composition as the conventional photosensor for the capacitative element (for it to be described as a capacitor below) which is an element which is needed for acquiring the integration value of a charge or current. Since the conventional photosensor uses only the semiconductor layer for inter-electrode to the layer from which accumulating a charge to inter-electrode [two] surely prevents movement of an electron and a hole to a purpose hatchet inter-electrode interlayer being required for a capacitor, the interlayer of a good property with little leak is thermally obtained because it is difficult.

[0018] Thus, it may become a problem serious since a process becomes mostly and complicated when the whole system which TFT and a capacitor a capacitor, and that matching is not good arrange a majority of two or more photosensors to a single dimension or two dimensions, and detects this lightwave signal one by one is constituted, when the yield is very bad and makes various functions highly efficiently equipment from a low cost in process or in property. [which are an element important when a photoelectrical inverter is constituted]

[0019] The purpose of the [purpose of invention] this invention has a high SN ratio, and it aims at offering the system which has the photoelectrical inverter whose property is stable, its drive method, and it.

[0020] Moreover, the yield of this invention is high and production aims at offering the system which has an easy photoelectrical inverter and easy it.

[0021] In addition, this invention can be formed in the same process as TFT, and it aims at offering the system which has a photoelectrical inverter producible by the low cost, its drive method, and it, without producing complication of a production process.
[0022]
[Means for Solving the Problem] this invention on an insulating substrate as the above-mentioned The means for solving a technical problem The first electrode layer, The insulating layer which prevents passage of the carrier of both carriers of the second mold with which positive/negative differs from the carrier of the first mold, and the carrier of the first mold of the above, The photoelectrical inverter which has the photoelectrical transducer which has the pouring blocking layer and the second electrode layer which prevent pouring of the carrier of the first mold of the above to a photo-electric-translation semiconductor layer and this semiconductor layer is offered.
[0023] moreover, this invention -- a substrate top -- the 1st electrode layer and the 2nd electrode layer -- this -- the insulating layer which prevents passage of the carrier of the 2nd different mold from the carrier of the 1st mold and this carrier which were formed between the 1st and 2nd electrode layers -- The system which has the signal-processing means which processes the signal from the plurality of the photoelectrical transducer which has the pouring blocking layer which prevents pouring of the carrier of the 1st mold of the above to a semiconductor layer and this semiconductor layer, and this photoelectrical transducer is offered.
[0024] Furthermore, the insulating layer from which this invention prevents passage of both carriers of the 2nd mold with which positive/negative differs from the 1st electrode layer, the carrier of the 1st mold, and the carrier of the 1st mold of the above on a substrate, It is the method of driving the photoelectrical transducer which has the 2nd electrode layer prepared through the pouring blocking layer which prevents the carrier of the 1st mold of the above being poured in into the semiconductor layer and this semiconductor layer. This drive method has refreshment mode and a photoelectrical translation mode, and sets them in the aforementioned refreshment mode. The electric field which lead the carrier of the 1st mold of the above to the electrode layer of the above 2nd from the aforementioned semiconductor layer are impressed. in the aforementioned photoelectrical translation mode The carrier of the 1st mold of the above generated by the light which carried out incidence to the aforementioned semiconductor is stopped in the aforementioned semiconductor layer, and the drive method of the photoelectrical inverter which impresses electric field in the direction which leads the carrier of the 2nd mold of the above to the electrode layer of the above 2nd is proposed.
[0025]
[Example] Hereafter, this invention is explained, referring to a drawing if needed.
[0026] [Example 1] drawing 1 (a) and drawing 1 (b) are a typical lamination view for explaining the photoelectrical transducer of the photoelectrical inverter concerning the 1st example of this invention in order, respectively, and the rough circuit diagram of a photoelectrical inverter.
[0027] In drawing 1 (a), the insulating substrate in which 1 is formed with glass etc., and 2 are lower electrodes formed by aluminum, Cr, etc. 70 is an insulating layer formed by the silicon nitride SiN from which an electron and a hole prevent passage, and the thickness is set as 500A or more which is thickness to the extent that it cannot pass through an electron and a hole by the tunnel effect. The photo-electric-translation semiconductor layer in which 4 is formed by i layers of intrinsic semiconductors of a hydrogenation amorphous silicon (a-Si:H), and 5 are n+ of a-Si which prevents pouring of the hole from a transparent-electrode 6 side in the photo-electric-translation semiconductor layer 4. The pouring blocking layer and transparent electrode 6 which are formed in a layer are formed with a compound, an oxide, etc. containing the indium or tin like ITO.
[0028] In drawing 1 (b), 100 is what symbolized the photoelectrical transducer shown by drawing 1 (a), and G shows [D] the electrode by the side of the lower electrode 2 the transparent-electrode 6 side. 120 is a detecting element, 110 is a power supply section, and a power supply section 110 consists of switches 113 which switch both positive supply 111 which gives an electropositive potential to D electrode, and negative supply 112 which gives an electronegative potential. A switch 113 is controlled by the photoelectrical translation mode the refresh side in refreshment mode to connect with the read

side.
[0029] Operation of the photoelectrical transducer 100 currently used by this example here is explained. Drawing 5 (a) and drawing 5 (b) are the energy-band views of a photoelectrical transducer showing operation of the refreshment mode of this example, and a photoelectrical translation mode, respectively, and express the state of the thickness direction of each class of a photoelectrical transducer.
[0030] In refreshment mode (a), the hole where D electrode was shown by the black dot in i layer 4 since the electronegative potential was given to G electrode is led to D electrode by electric field. i layers of electrons shown with a circle [white] simultaneously are poured into 4. n-layer 5 or i layers, at this time, in 4, some of holes and electrons are recombined and disappear. If this state continues time long enough, the hole in i layer 4 will be swept out from 4 i layers (drawing 5 (a)).
[0031] If it becomes a photoelectrical translation mode (b) in this state, since, as for D electrode, an electropositive potential is given to G electrode, the electron in i layer 4 will be led to D electrode in an instant. However, a hole is not led to 4 i layers, in order that 5 [n-layer] may work as a pouring blocking layer. If light carries out incidence into i layer 4 in this state, light will be absorbed and an electron and a hole pair will generate it. this electron -- electric field -- D electrode -- **** -- he and a hole move in the inside of i layer 4, and reach the interface of an insulating layer 70 However, since it cannot move into an insulating layer 70, it will stop in i layer 4. In order for an electron to move to D electrode at this time, to move a hole to insulating-layer 70 interface in i layer 4 and to maintain the electrical neutrality in an element, current flows from G electrode to a detecting element 120. Since this current corresponds to the electron and hole pair generated by light, it is proportional to the light which carried out incidence (drawing 5 (b)).
[0032] the hole which had stopped in i layer 4 when it changed into the state in refreshment mode (a) again, after maintaining a certain period photoelectrical translation mode (b) -- above -- D electrode -- **** -- he and the charge corresponding to this hole flow to a detecting element 120 simultaneously The amount of this hole corresponds to the total amount of the light which carried out incidence to the photoelectrical translation-mode period, and the charge which flows to a detecting element 120 corresponds to the total amount of light. What is necessary is to carry out the fixed hatchet difference of this amount about, to subtract it, and just to detect it, although the charge corresponding to the amount of the electron poured in into i layer 4 at this time also flows.
[0033] That is, while the photoelectrical transducer 100 in this example outputs the amount of the light which carries out incidence to real time, it can also output the total amount of the light which carried out incidence to a certain period. This can be called big feature of this example. A detecting element 120 should just detect either or both according to the purpose.
[0034] Operation of this example is explained here using drawing 6 .
[0035] Drawing 6 is the timing chart of operation in the photoelectrical inverter of drawing 1 . The inside Vdg of drawing is the potential of D electrode to G electrode of the photoelectrical transducer 100, P shows the state of the incidence of light, there is no light at ON and there is no incidence of light at an incident state and OFF. That is, the dark state is shown. IS The current which flows into ******** 120 is shown and the direction of a horizontal axis shows the passage of time.
[0036] If the introduction switch 113 is connected in the refresh direction, it will go into refreshment mode, and Vdg serves as negative voltage, and a hole is swept out like drawing 5 (a), and it follows on i layers of electrons being poured into 4, and the negative rush current E shown by E of drawing 6 flows to a detecting element 120. After that, the electron in i layer 4 will be swept out, positive rush current E' will flow, and refreshment mode will go into a photoelectrical translation mode, if it ends and a switch 113 is connected in the read direction. If incidence of this Tokimitsu is carried out, the photocurrent A shown by A will flow. If it is in a dark state in the same operation, as shown by A', current will not flow. Therefore, the incidence of light is detectable if Photocurrent A is integrated with Photocurrent A during a direct or fixed period.
[0037] Moreover, if a switch 113 is connected in the refresh direction from the state of A, the rush current B will flow. This becomes the amount reflected in the total amount of the incidence of the light in the last photoelectrical translation-mode period, and should just acquire the value of integration or

integration for this rush current B. The incidence of light is detectable, if light has not carried out incidence by the last photoelectrical translation mode, the rush current becomes small like B' and the difference is detected. Moreover, above-mentioned rush current E' and E ", since it is equal to rush current B' about, you may deduct these from the rush current B.
[0038] Furthermore, if the state of the incidence of light changes even if it is the same photoelectrical translation-mode period, it will be information separator like C and C'. It changes. Even if it detects this, the incidence state of light is detectable. That is, it is shown that refreshment mode does not necessarily need to take each time for every detection opportunity.
[0039] However, for a certain reason, although the period of a photoelectrical translation mode becomes long, or there is incidence of light like D when the illuminance of the light which carries out incidence is strong, current may not flow. the electron into which many holes stopped in i layer 4, and the electric field in i layer 4 became small, and generated it like drawing 5 (c) since this was this hole -- D electrode -- **** -- he becomes there is not less and it is because it recombines with the hole in i layer 4 If the state of the incidence of light changes in this state and it will be again made refreshment mode although current may flow unstably, the hole in i layer 4 will be swept out and current equal to A will be acquired like A " in the following photoelectrical translation mode.
[0040] In the above explanation, although the incident light was fixed and being explained, it cannot be overemphasized that both the current of A, B, and C changes with the strength of an incident light continuously, and it can detect quantitatively not only about detection of the existence of an incident light but about strength.
[0041] Moreover, in the above-mentioned explanation, although an ideal sweeps out all holes when sweeping out the hole in i layer 4 in refreshment mode, it is also effective to sweep out some holes, and the case where all are swept out in A or C which is a photocurrent, and a value do not change, but it is satisfactory. Moreover, if it sweeps out so that a constant rate may always remain, the amount of light is quantitatively detectable with the current of B. That is, what is necessary is for it to be good if current value will not be in the state of D, i.e., the state of drawing 5 (c), in the detection opportunity in the following photoelectrical translation mode, and just to decide the property of a pouring blocking layer of the voltage of Vdg in refreshment mode, the period in refreshment mode, and n layer 5.
[0042] Furthermore, in refreshment mode, i layers of pourings of the electron of 4 are not a requirement, and the voltage of Vdg is not limited to negative, either. i layers of a part of holes should just be swept out from 4. When i layers of many holes have stopped at 4, even if Vdg is positive voltage, the electric field in i layer 4 will be because it is added in the direction which leads a hole to D electrode. It is not a requirement that the property of the pouring blocking layer of 5 can pour similarly n layers of i layers of electrons into 4.
[0043] Drawing 7 (a), drawing 7 (b), drawing 7 (c), and drawing 7 (d) show the example of composition of a detecting element, respectively. For a voltmeter and 123, as for a capacitor and 125, a resistor and 124 are [the ammeter with which 121 is represented with Current Amp, and 122 / a switching device and 126] operational amplifiers.
[0044] Drawing 7 (a) detects direct current and the outputs of an ammeter 121 are voltage and amplified current. Drawing 7 (b) passed current to the resistor 123, and has detected voltage with the voltmeter 122. Drawing 7 (c) accumulated the charge to the capacitor 124, and has detected the voltage with the voltmeter 122. Drawing 7 (d) has detected the integration value of current as voltage by the operational amplifier 126. In drawing 7 (c) and drawing 7 (d), the role which gives initial value to detection at each time is carried out, and a switching device 125 can also be transposed to the resistor of high resistance by the method of detection.
[0045] What consists of an operational amplifier which combined a transistor and this, resistance, a capacitor, etc., and operates at high speed can be used for an ammeter or a voltmeter. A detecting element is not limited to these four sorts, and combines the detector which detects current or a voltage value, a resistor, a capacitor, and a switching device that what is necessary is just to be able to detect a direct or integration value for current or a charge, and **** or constituting so that it may output one by one can also do two or more photoelectrical transducers.

[0046] When it constitutes a line sensor and an area sensor, the potential of 1000 or more photoelectrical transducers is controlled and detected by the matrix combining wiring and the switching device of a power supply section. In this case, if a switching device, a capacitor, and a part of resistance are constituted on the same substrate as a photoelectrical transducer, they are advantageous in respect of an SN ratio and cost. In this case, the photoelectrical transducer of this example can be simultaneously formed in the same process for the same film composition as TFT which is a typical switching device, and can realize the photoelectrical inverter of a high SN ratio of a low cost.

[0047] [Example 2] drawing 8 is the circuit diagram showing the 2nd example of the photoelectrical inverter of this invention. In addition, the same sign is given to the same portion as drawing explained previously. About the lamination of the photoelectrical transducer 100, it is the same as that of drawing 3 (a). The power supply to which 114 gives an electropositive potential to D electrode, the power supply to which 115 gives an electropositive potential to G electrode in the refreshment mode of a photoelectrical transducer, and 116 are transfer-switch elements which switch each mode. At this time, the power supply 115 is set as equivalent to a power supply 114, or the high voltage.

refresh mode

[0048] In this example, it has the four modes thinly and they are ** photoelectrical transducer refreshment mode, **G electrode initialization mode, ** accumulation mode, and ** detection mode, respectively. ** photoelectrical transducer refreshment mode -- the refreshment mode of the aforementioned example -- moreover, the electric field of operation of a ****** cage and the photoelectrical transducer 100 are fundamentally the same as that of the direction as photoelectrical translation-mode [of the aforementioned example], and photoelectrical transducer 100 each class where G electrode initialization mode of **, **, and **, accumulation mode, and detection mode are the same Each mode is explained one by one below.

photoel. mode (conv.)

[0049] In photoelectrical transducer refreshment mode **, a switching device 116 is connected to the position of refresh in drawing, and an electropositive potential is given to G electrode by the power supply 115. The electropositive potential is given to D electrode by the power supply 114, and it means that it is got blocked and, as for the potential Vdg to the potential of G electrode of D electrode, about 0 or negative voltage was given. Then, the hole in the photoelectrical transducer 100 is swept out and refreshed.

[0050] Next, it connects with the position of GND, a switching device 116 shifts to G power supply initialization mode **, and, as for G electrode, GND potential is given. At this time, Vdg becomes positive voltage, and the photoelectrical transducer 100 becomes a photoelectrical translation mode, after the rush current flows.

[0051] Next, a switching device 116 becomes the position of open, it shifts to accumulation mode ** and G electrode becomes open in direct current. However, it is the equivalence capacity component CS of the photoelectrical transducer 100 shown by the dotted line in fact. Stray capacity CO Potential is maintained. As for the potential of outflow and G electrode, the current which corresponds if light is carrying out incidence to the photoelectrical transducer 100 here goes up from G electrode. That is, CS CO The incidence information on light is accumulated as a charge. If the fixed after [the storage time of] switching device 116 is connected to the position of sense, it will shift to detection mode ** and the potential of G electrode will be again returned to GND potential. At this time, they are CS and CO simultaneously. Although the accumulated charge flows to a detecting element 120, this charge is equal to the integration of the current which flowed out of the photoelectrical transducer 100 in accumulation mode, that is, is detected by the detecting element 120 as a total amount of the incidence of light.

[0052] Furthermore, a switching device 116 is again connected to a refresh position, and operation is repeated below.

[0053] Above, the feature of this example is the combination of an easy element, the integration value of the current which flowed to the fixed, prolonged storage time is in the place obtained for a short period of time in detection mode, and this shows that the photoelectrical inverter with two or more photoelectrical transducers of a high SN ratio can consist of low costs.

[0054] Although operation of the photoelectrical transducer of this example is fundamentally equal to the 1st example, a different point is that the potential of G electrode rises and Vdg falls into a

photoelectrical translation mode. Although it can say that this will tend to be in the state which shows by (c) of drawing 5 in the amount of incidence of a few light and can grow into a limit of the amount of incident lights in normal operation, this is stray capacity CO. It is easily improvable by inserting the big capacitor for accumulation positively in parallel.
[0055] Moreover, fundamental operation is not affected, although a detecting element 120 consists of a capacitor 124, a switching device 125, and an operational amplifier 126, stores the charge which flowed in at the time of detection mode in a capacitor 124, and transforms it into voltage, it is outputting through a buffer amplifier and G electrode does not become perfect GND potential at the time of detection mode for this reason. In addition, a capacitor 124 is initialized by the switching device 125 at the time of other modes. Moreover, the transfer-switch element 116 does not need to be multipolarity, for example, can also constitute a switching device like TFT from three pieces.
[0056] [Example 3] drawing 9 (a), drawing 9 (b), and drawing 9 (c) are the lamination views showing another example of the photoelectrical transducer 100, respectively. In addition, the same sign is given to the same portion as drawing explained previously.
[0057] In drawing 9 (a), 101 is a transparent insulating substrate and 21 is a lower transparent electrode using the transparent conductive layer. It is an up electrode, and 61 does not necessarily need to be transparent and is good with metals, such as aluminum. An incident light passes the transparent insulating substrate 101, a transparent electrode 21, and an insulating layer 70, and they carry out incidence to 4 i layers.
[0058] In drawing 9 (b), 62 is an up electrode and this electrode has not covered 5 [n-layer] completely. Therefore, light can pass 5 [n-layer] and can carry out incidence to 4 i layers. That is, an electrode 62 does not need to be well transparent with metals, such as aluminum. A carrier is outputted outside through the up electrode 62.
[0059] Drawing 9 (c) has deposited the electrode 61 on i layer 4 directly. In this composition, i layers of pourings of the hole of 4 are prevented from the electrode 61 in the electrode 61 and the Schottky barrier layer which i layers can do from the difference of the work function of 4. Therefore, n layer 5 described previously does not need to accumulate and it can constitute the photoelectrical inverter of a low cost further.
[0060] A photoelectrical transducer is not limited to what was shown in the example so that clearly from the above explanation. That is, there are an insulating layer which prevents the first electrode layer, hole, and electron transfer, a photo-electric-translation semiconductor layer, and the second electrode layer, and there should just be a pouring blocking layer which prevents pouring of the hole to a photo-electric-translation semiconductor layer between the second electrode layer and a photo-electric-translation semiconductor layer.
[0061] Moreover, in the above explanation, the relation of the hole and electron which are a carrier may be made reverse, and may be constituted. For example, ****** [the number of pouring blocking layers / p]. In this case, in above-mentioned explanation, if impression of voltage or electric field is made reverse and other composition sections are constituted, it will become the same operation.
[0062] Furthermore, a photo-electric-translation semiconductor is not limited to i layers. Light should just have the photoelectrical converter ability which carries out incidence and generates an electron and a hole pair. Lamination could come out further, either, and could be constituted from a multilayer, and composition etc. was continuously changed in the direction of thickness, and the property could be changed continuously.
[0063] Furthermore, not all insulating substrates also need to be insulators and the insulator could deposit them on the conductor or the semiconductor. Moreover, the order of deposition of each class to an insulating-substrate top may not be limited to the first electrode and insulating-layer --, either, but the composition of the second electrode and pouring blocking-layer -- which carried out the laminating to order, i.e., reverse order, is conversely sufficient as it.
[0064] When it has the photoelectrical transducer of composition of that drawing 9 (a) - drawing 9 (c) explained, of course, it cannot be overemphasized that the drive method mentioned above is applicable.
[0065] TFT200 which is the optoelectric transducer 100 in the photoelectrical inverter which [example

4] drawing 10 (a) requires for this example, and a switching device and the typical lamination view of a wiring layer 400, and drawing 10 (b) are the rough circuit diagrams of a photoelectrical inverter. In drawing 10 (a), the portion shown by the same number as drawing 3 shows the same thing.
[0066] Forming the lower electrode 2 and the up electrode 6 by the opaque electrode in this example, the up electrode 6 is made the composition which does not cover the pouring blocking layer 5 completely, and makes incidence of light more possible than the upper part through the pouring blocking layer 5. However, if the upper part or a lower electrode is formed, for example by transparent electrodes, such as ITO, the wrap composition of the up electrode 6 is also possible for the incidence of light in the pouring blocking layer 5.
[0067] Moreover, the gate electrode in which 202 is formed by aluminum, Cr, etc., the gate insulating layer in which 207 is formed by the silicon nitride SiN, the semiconductor layer in which 204 was formed by i layers of intrinsic semiconductors of hydrogenation amorphous silicon a-Si, and 205 are ohmic-contact layers formed by n layers of a-Si to which an electron transfer is carried out between the semiconductor layer 204, the source electrode 206, and the drain electrode 208.
[0068] The source electrode 206 and the drain electrode 208 are formed with metals, such as aluminum and Cr, or contest polysilicon. Moreover, the up electrode 106 of an optoelectric transducer 100 and the source electrode 206 of TFT200 are connected with the wiring 406 of aluminum or Cr.
[0069] The lamination of a photoelectrical transducer and TFT is the same and it is possible to be able to form membranes simultaneously with the same material, and to also form a wiring layer simultaneously with a photoelectrical transducer and each electrode of TFT on the same insulating substrate 1, so that clearly from drawing, and it can form in a simple process by constituting from a common film.
[0070] In addition, although, as for TFT200 which is a switching device in drawing 10 (a), the example to which one was connected is shown, this is not necessarily restricted to one.
[0071] In drawing 10 (b), 100 is what symbolized the optoelectric transducer shown by drawing 10 (a), and G shows [D] the electrode by the side of the lower electrode 2 the up electrode 6 side. 120 is a detecting element, 110 is a power supply section, and a power supply section 110 consists of a positive supply 111 which gives an electropositive potential to D electrode, and a negative supply 112 which gives an electronegative potential. Moreover, as for the inside 210 and 211 of drawing, it is what symbolized TFT shown by drawing 10 (a), and g, s, and d show the gate electrode 202, the source electrode 206, and the drain electrode 208, respectively. Although it represents with drawing 10 (a) as mentioned above, and it is referred to as TFT200 and one piece is shown, as shown in drawing 10 (b) in fact, TFT 210 and 211 is formed on the same insulating substrate. It connects with the control section 130, and each gate electrode is controlled so that read-TFT211 turns on in refreshment mode by this control section 130 at refresh-TFT210 and a photoelectrical translation mode.
[0072] In addition, in this example, the switch 113 explained in the example 1 is concretely shown in read-TFT211 and refresh-TFT210, and although depending read in an example 1 and selection of refresh on a signal from a control section 130 is specified in drawing 10 (b), the explanation in an example 1 is applicable about the drive method of a photoelectrical transducer.
[0073] Since at least a part can form a photoelectrical transducer and TFT which is a typical switching device by the same lamination in this example, deposition and the photoelectrical inverter which could carry out patterning and was excellent in the high yield, the low cost, and the high SN ratio can be simultaneously offered for a required layer in the same process.
[0074] TFT200 which is the photoelectrical transducer 100 in the photoelectrical inverter which [example 5] drawing 11 (a) requires for the 5th example of this invention, and a switching device, the capacitor 300 which is capacitative element and the typical block diagram of the layer of a wiring layer 400, and drawing 11 (b) are the rough circuit diagrams of a photoelectrical inverter applicable to drawing 11 (a). In drawing 11 (a) and drawing 11 (b), since the thing of the same number as drawing 10 (a) and drawing 10 (b) shows the same member, it omits explanation here.
[0075] In addition, in drawing 11 (a), the lower electrode of the capacitor by which 302 is formed by aluminum, Cr, etc., the insulating layer in which 307 is formed by the silicon nitride SiN, the semiconductor layer in which 304 was formed by i layers of intrinsic semiconductors of hydrogenation

amorphous silicon a-Si, and 305 are ohmic-contact layers formed by n layers of a-Si to which an electron transfer is carried out between the semiconductor layer 304 and the capacitor up electrode 306. The up electrode 306 of a capacitor is formed by aluminum or Cr. The 304/ohmic-contact layer 305 of 307/semiconductor layers of insulating layers works as an interlayer of a capacitor 300, and since the insulating layer 307 is included, the good capacitor with little leak is formed here. Moreover, the lower electrode 102 of an optoelectric transducer 100 and the lower electrode 302 of a capacitor are connected with the wiring 402 of aluminum or Cr.

[0076] The lamination of each element is the same and it is possible for each class to be simultaneously formed with the same material on the same insulating substrate 1, and to also form a wiring layer simultaneously with the electrode of each element so that clearly from drawing, and it can form in a simple process by constituting from a common film.

[0077] DETECT driven by the signal from a control section 130 in drawing 11 (b) compared with drawing 10 (b) The point in which TFT (TFT for detection)212 is inserted between the photoelectrical transducer 100 and the detecting element 120 differs from the point that one electrode of the photoelectrical transducer 100 is grounded through the capacitor 300.

[0078] moreover -- although one TFT is only shown in drawing 11 (a) also in this example -- an example 4 -- the same -- a typical example -- being shown -- **** -- read which does not pass but is shown in drawing 11 (b) TFT211 and refresh TFT210 and DETECT That it is not necessary to say can form TFT212 on the same substrate.

[0079] it was shown in drawing 11 (b) -- as -- TFT 210-212 -- it forms on [both] the same insulating substrate It connects with the control section 130, and each gate electrode is controlled so that read-TFT211 turns on in the fresh mode by this control section 130 at refresh-TFT210 and a photoelectrical translation mode. Moreover, detect-TFT212 is controlled on/off [the timing which detects the integration value of the output of the optoelectric transducer accumulated at the capacitor 300] suitably.

[0080] About the drive of the photoelectrical inverter of this example, the drive method explained in the example 1 as well as an example 4 is applicable. However, since the charge is accumulated to the capacitor 300 in this example, it explains anew using drawing 5 and drawing 6 .

[0081] Although D electrode has not covered n layers completely in this example, since, as for for D electrode and n layers, an electron transfer is performed freely, D electrode and the potential of n layers are always these potentials, and are premised on it by the following explanation. Moreover, G electrode can give GND potential through a detecting element between patent periods, and is about maintained at GND potential by the capacitor 300 also in an accumulation period.

[0082] Since, as for D electrode, the electronegative potential is given to G electrode in drawing 5 (a) in refreshment mode, the hole shown by the black dot in i layer 4 is led to D electrode by electric field. i layers of electrons shown with a circle [white] simultaneously are poured into 4. n-layer 5 or i layers, at this time, in 4, some of holes and electrons are recombined and disappear. If this state continues time long enough, the hole in i layer 4 will be swept out from 4 i layers.

[0083] Since, as for D electrode, an electropositive potential will be given to G electrode if it becomes drawing 5 (b) of a photoelectrical translation mode in this state, the electron in i layer 4 is led to D electrode in an instant. However, a hole is not led to 4 i layers, in order that 5 [n-layer] may work as a pouring blocking layer. If light carries out incidence into i layer 4 in this state, light will be absorbed and an electron and a hole pair will generate it. This electron is led to D electrode by electric field, and a hole moves in the inside of i layer 4, and gives i layers to the interface of 4 and an insulating layer 70. However, since it cannot move into an insulating layer 70, it will stop in i layer 4. In order for an electron to move to D electrode at this time, and to move a hole to insulating-layer 70 interface in i layer 4, and to maintain the electrical neutrality in an element, current flows from G electrode to a capacitor 300. Since this current corresponds to the electron and hole pair generated by light, it is proportional to the light which carried out incidence. If it will be in the state of drawing 5 (a) in refreshment mode again after maintaining drawing 5 (b) of a certain period photoelectrical translation mode, the hole which had stopped at 4 i layers will be led to D electrode as mentioned above, and the current corresponding to this hole will flow to a capacitor 300 simultaneously. The amount of this hole corresponds to the total

amount of the light which carried out incidence to the photoelectrical translation-mode period, and current corresponds to the total amount of light. What is necessary is to carry out the fixed hatchet difference of this amount about, to subtract it, and just to detect it, although the current corresponding to the amount of the electron poured in into i layer 4 at this time also flows. That is, while the optoelectric transducer 100 in this example outputs the amount of the light which carries out incidence to real time, it can also output the total amount of the light which carried out incidence to a certain period. This can be called big feature of this example. A capacitor 300 accumulates the output of the purpose among these outputs, and should just detect the integration value by the detecting element 120 by turning on detect-TFT.

[0084] Next, operation of this example is explained. Drawing 6 is the timing chart of operation in the photoelectrical inverter of drawing 11 (a). The inside Vdg of drawing is the potential of D electrode to G electrode of an optoelectric transducer 100, P shows the state of the incidence of light, there is no light at ON, and there is no incidence of light at an incident state and OFF, that is, the dark state is shown. IS The current which flows into the ** capacitor 300 is shown, and the direction of a horizontal axis shows the passage of time. The negative rush current E which it goes into refreshment mode, Vdg will serve as negative voltage and a hole will be swept out like drawing 2 (a) if refresh-TFT210 is turned on [it] by the introduction control section 130, and follows on i layers of electrons being poured into 4, and is shown in a capacitor 300 by drawing 6 E flows. When refreshment mode is ended after that and read-TFT211 is controlled by on simultaneously [refresh-TFT210] with off, it becomes right voltage, the electron in i layer 4 is swept out, positive rush current E' flows, and Vdg is in a photoelectrical translation mode. If incidence of this Tokimitsu is carried out, the photocurrent shown by A will flow. If it is in a dark state in the same operation, as shown by A', current will not flow. Therefore, the incidence of light is detectable if it integrates with Photocurrent A during a fixed period. Moreover, if refresh-TFT210 is controlled by on from the state of A, the rush current B will flow. This becomes the amount reflected in the total amount of the incidence of the light in the last photoelectrical translation-mode period, and if it integrates with this rush current B, it can detect the incidence of light. The incidence of light is detectable, if light has not carried out incidence by the last photoelectrical translation mode, the rush current becomes small like B' and the difference is detected. Moreover, above-mentioned rush current E' and E ", since it is equal to rush current B' about, you may deduct this from the rush current B. That is, what is necessary is just to find the integral from just before the rush current B to until immediately after E " of rush currents by the capacitor 300. This is also the feature of this example and is nothing (E" of rush current B-rush currents) in a special subtraction machine.

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[0085] Furthermore, if the state of the incidence of light changes even if it is the same photoelectrical translation-mode period, it will be information separator like C and C'. It changes. Even if it integrates with this, the incidence state of light is detectable. That is, it is shown that refreshment mode does not necessarily need to take each time for every detection opportunity.

[0086] However, although the period of a photoelectrical translation mode becomes long for a certain reason, or there is incidence of light like D when the illuminance of the light which carries out incidence is strong, current may not flow. This is because many holes stop in i layer 4, the electric field in i layer 4 become small like drawing 5 (c) since it is this hole, and the generated electron is no longer led to D electrode and recombines with the hole in i layer 4. If the state of the incidence of light changes in this state and it will be again made refreshment mode although current may flow unstably, the hole in i layer 4 will be swept out and current equal to A will be acquired like A " in the following photoelectrical translation mode.

[0087] How to acquire the integration value by the capacitor 300 here is explained. detect-TFT212 is first turned on by the control section 130, and GND potential is given to a capacitor 300 through a detecting element. It is not necessary to detect the flowing charge by the detecting element 120 at this time. Next, detect-TFT212 is turned off and integration begins. The current to which it flowed to the capacitor 300 during the integration period is stored in a capacitor 300 as a charge. Although it is [some] at this time and the potential of a capacitor 300 rises, this hardly influences operation of an

optoelectric transducer 100. If detect-TFT212 is turned on after finding the integral during a certain fixed period, the charge stored in the capacitor 300 will flow to a detecting element 120 through detect-TFT212. Since this current corresponds to the integration value with which it integrated during a fixed period, it should just detect this by the detecting element 120.

[0088] In the above explanation, although the incident light was fixed and being explained, it cannot be overemphasized that both the current of A, B, and C changes with the strength of an incident light continuously, and it can detect quantitatively not only about detection of the existence of an incident light but about strength.

[0089] Moreover, in the above-mentioned explanation, although an ideal sweeps out all holes when sweeping out the hole in i layer 4 in refreshment mode, it is also effective to sweep out some holes, and the case where all are swept out in A or C which is a photocurrent, and a value do not change, but it is satisfactory. Moreover, if it sweeps out so that a constant rate may always remain, the amount of light is quantitatively detectable with the current of B. That is, what is necessary is for it to be good if current value will not have been in the state of D, i.e., the state of (c) of drawing 5 , in the detection opportunity in the following photoelectrical translation mode, and just to decide the property of the period in the voltage of Vdg in refreshment mode, and refreshment mode, and the pouring blocking layer of n layer 5. Furthermore, in refreshment mode, i layers of pourings of the electron of 4 are not a requirement, and the voltage of Vdg is not limited to negative, either. When i layers of many holes have stopped at 4, even if it compares and Vdg is positive voltage, the electric field in i layers are because it is added in the direction which leads a hole to D electrode. It is not a requirement that the property of the pouring blocking layer of 5 can pour similarly n layers of i layers of electrons into 4.

[0090] In addition, many types which gave and explained an example to drawing 7 as a detecting element can be used.

[0091] Since it has the capacitor 300 in this example, the signal in which the desired period carried out photo electric translation can be accumulated, and high sensitivity and high SN ratio-ization can be achieved further.

[0092] [Example 6] drawing 12 is the circuit diagram showing the 6th example of the photoelectrical inverter of this invention. In addition, the same sign is given to the same portion as drawing explained previously. About the lamination of TFT 220-222 which is an optoelectric transducer 100 and a switching device, the optoelectric transducer 100 of drawing 10 (a) and TFT200 are applicable. the power supply Vd to which 114 gives an electropositive potential to D electrode, and power supply Vg to which 115 gives an electropositive potential to G electrode in the refreshment mode of an optoelectric transducer it is . At this time, the power supply 115 is set as equivalent to a power supply 114, or the high voltage. The gate electrode of each TFT 220-222 is having on/off controlled by control sections 131-133, respectively. The portion 120 surrounded with the dashed line is a detecting element, and the light which carries out incidence to an optoelectric transducer 100 so that it may state below is detected.

[0093] In this example, it has the four modes finely and they are ** optoelectric-transducer refreshment mode, **G electrode initialization mode, ** accumulation mode, and ** detection mode, respectively. ** the refreshment mode of the example of the above [optoelectric-transducer refreshment mode] -- moreover, G electrode initialization mode of **, **, and **, accumulation mode, and detection mode corresponded with the photoelectrical translation mode of the aforementioned example, electric field have joined each class of an optoelectric transducer 100 in the same direction, and operation of an optoelectric transducer 100 is fundamentally the same Each mode is explained one by one below. By optoelectric-transducer refreshment mode **, TFT220 turns on by the control section 131 after three TFT's 220-222 turning off, and it is an electropositive potential Vg in G electrode by the power supply 115. It is given. In D electrode, it is an electropositive potential Vd by the power supply 114. It is given, and it means that it is got blocked and, as for the potential Vdg to the potential of G electrode of D electrode, (Vd-Vg) was given. Then, the hole in an optoelectric transducer 100 is swept out and refreshed. Next, TFT221 turns on by the control section 132 after TFT's220 turning off, it shifts to G electrode initialization mode **, and, as for G electrode, GND potential is given. At this time, Vdg becomes positive voltage, and an optoelectric transducer 100 becomes a photoelectrical translation

mode, after the rush current flows. Next, TFT221 turns off and G electrode becomes open in direct current. However, it is the equivalence capacity component CS of an optoelectric transducer 100 shown by the dotted line in fact. Stray capacity CO Potential is maintained. As for the potential of outflow and G electrode, the current which corresponds if light is carrying out incidence to the optoelectric transducer 100 here goes up from G electrode. That is, CS CO The incidence information on light is accumulated as a charge. TFT222 turns on by the fixed after [the storage time of] control section 133, and it shifts to detection mode **. At this time, it is CS. CO This charge is detected by the integrator which corresponded to the integration value of the current which flowed out of the optoelectric transducer 100 in accumulation mode, that is, consisted of an operational amplifier 126, a capacitor 124, and a switching device 125 as a total amount of the incidence of light although the accumulated charge flows to an operational amplifier 126 side through TFT222. This integrator turns on a switching device 125 by the control section which is not illustrated before shifting to detection mode **, and discharges and initializes the capacitor 124. Furthermore, TFT220 turns on again by the control section 131 after TFT's222 turning off, and operation is repeated below.

[0094] As mentioned above, it is shown that the integration value of the current which is the combination of an element and flowed to the fixed, prolonged storage time has the feature of this example in the place obtained by the short time in detection mode, and the photoelectrical inverter of a high SN ratio in which the load of the operational amplifier which is high cost has two or more light optoelectric transducers can constitute it from a low cost. Although operation of the optoelectric transducer of this example is fundamentally equal to the 1st example, a different point is that the potential of G electrode rises and Vdg falls into a photoelectrical translation mode. Although this will tend to be in the state which shows by drawing 5 (c) in the amount of incidence of a few light and it may become a limit of the amount of incident lights in normal operation, this is stray capacity CO. It is easily improvable by inserting the big capacitor for accumulation positively in parallel.

[0095] The typical cross section between A-B illustrated with the typical plan of drawing 13 (a) to the typical plan of a photoelectrical inverter shown in drawing 13 (a) by drawing 12 and drawing 13 (b) is shown. The same sign as drawing 12 shows the portion which is not illustratable in detail in drawing 13 (a). It is the wiring with which 100 connects an optoelectric transducer and, as for TFT, 402, and 406, 220-222 connect each element electrically, and connects through the contact hole 408. In drawing 13 (b), 412 and 416 are wiring connected to other composition sections. Drawing 13 explains the formation method of each element in order here.

[0096] First, about 500A of Cr(s) is made to deposit as a lower metal layer 2 by the spatter etc. on the glass substrate 1 which is an insulating material, patterning is carried out by the photolithography after that, and unnecessary area is **********ed. Thereby, the lower electrode of an optoelectric transducer 100, the gate electrode of TFT 220-222, and the lower wiring 402 and 412 are formed.

[0097] Next, 5 (about 2000A / 5000A / 500A) is deposited a SiN 70/i layer layer [4/n-layer] within the same vacuum by CVD, respectively. These each class turns into the insulating layer / photo-electric-translation semiconductor layer / hole pouring blocking layer of an optoelectric transducer 100, and the gate insulator layer / semiconductor layer / ohmic-contact layer of TFT 220-222. Moreover, it is used also as a cross section insulating layer of vertical wiring. Although not only this but the voltage used as a photoelectrical inverter, current, a charge, the amount of incident lights, etc. can design the thickness of each class the optimal, SiN at least has desirable 500A or more whose function cannot pass through an electron and a hole and is possible as a gate insulator layer of TFT.

[0098] The area which becomes a contact hole 408 is **********ed after class deposition, and about 10000A of aluminum is made to deposit in a spatter etc. as an up metal layer 6 after that. Furthermore, patterning is carried out by photograph ring RAFI, unnecessary area is **********ed, and the source electrode which are the up electrode of an optoelectric transducer 100 and a main electrode of TFT 220-222, a drain electrode, and the up wiring 406 and 416 are formed. By the contact hole 408, the lower wiring 402 and the up wiring 406 are connected simultaneously.

[0099] Furthermore, only the channel section of TFT 220-222 **********s n layers by RIE, 5 is **********ed a SiN 70/i layer layer [4/n layer] unnecessary after that, and each element is separated.

An optoelectric transducer 100, TFT 220-222, the lower wiring 402,412, the up wiring 406,416, and a contact hole 408 are completed now. Moreover, it usually covers the upper part of each element by passivation films, such as SiN, in order to raise endurance, although illustration has not been carried out.

[0100] It can form only by etching of 5 and the up metal layer 6, and each class the common lower metal layer 2 which an optoelectric transducer 100, TFT 220-222, and the wiring section 300 deposited simultaneously by this example as the above explanation, and a SiN 7/i layer layer [4/n layer]. Moreover, further, on the property of TFT, a pouring blocking layer has only one place into an optoelectric transducer 100, and it can form within the same vacuum, and it can form within the same vacuum, and it is a high yield synthetically and important gate insulator layer / i layer interface are also enabling production of a highly efficient photoelectrical inverter by the low cost.

[0101] [Example 7] drawing 14 is the circuit diagram showing the 7th example of the photoelectrical inverter of this invention. In addition, the same sign is given to the portion of the same function as drawing explained previously. About the lamination of an optoelectric transducer 100, TFT 220-222, and a capacitor 300, it is the same as that of drawing 11 (a). the power supply Vd to which 114 gives an electropositive potential to D electrode, and power supply Vg to which 115 gives an electropositive potential to G electrode in the refreshment mode of an optoelectric transducer it is . At this time, the power supply 115 is set as equivalent to a power supply 114, or the high voltage. The gate electrode of each TFT 220-222 is having on/off controlled by control sections 131-133, respectively. The portion 120 surrounded with the dashed line is a detecting element, and the light which carries out incidence to an optoelectric transducer 100 so that it may state below is detected.

[0102] In this example, it has the four modes finely and they are ** optoelectric-transducer refreshment mode, **G electrode initialization mode, ** accumulation mode, and ** detection mode, respectively. ** the refreshment mode of the example of the above [optoelectric-transducer refreshment mode] -- moreover, G electrode initialization mode of **, **, and **, accumulation mode, and detection mode corresponded with the photoelectrical translation mode of the aforementioned example, electric field have joined each class of an optoelectric transducer 100 in the same direction, and operation of an optoelectric transducer 100 is fundamentally the same Each mode is explained one by one below. By optoelectric-transducer refreshment mode **, TFT220 turns on by the control section 131 after three TFT's 220-222 turning off, and it is an electropositive potential Vg in G electrode by the power supply 115. It is given. In D electrode, it is an electropositive potential Vd by the power supply 114. It is given, and it means that it is got blocked and, as for the potential Vdg to the potential of G electrode of D electrode, (Vd-Vg) was given. Then, the hole in an optoelectric transducer 100 is swept out and refreshed. Next, TFT221 turns on by the control section 132 after TFT's220 turning off, it shifts to G electrode initialization mode **, and, as for G electrode, GND potential is given. At this time, Vdg becomes positive voltage, and an optoelectric transducer 100 becomes a photoelectrical translation mode, after the rush current flows. Next, TFT221 turns off and G electrode becomes open in direct current. However, potential is maintained by the capacitor 300. As for the potential of outflow and G electrode, the current which corresponds if light is carrying out incidence to the optoelectric transducer 100 here goes up from G electrode. That is, the incidence information on light is accumulated as a charge at a capacitor 300. TFT222 turns on by the fixed after [the storage time of] control section 133, and it shifts to detection mode **. This charge is detected by the integrator which corresponded to the integration value of the current which flowed out of the optoelectric transducer 100 in accumulation mode, that is, consisted of an operational amplifier 126, a capacitor 124, and a switching device 125 as a total amount of the incidence of light although the charge accumulated at the capacitor 300 at this time flows to an operational amplifier 126 side through TFT222. This integrator turns on a switching device 125 by the control section which is not illustrated before shifting to detection mode **, and discharges and initializes the capacitor 124. Furthermore, after TFT's222 turning off, TFT220 turns on again by the control section 131, and operation is repeated below.

[0103] It is shown that the integration value of the current which is the combination of an easy element and flowed to the fixed, prolonged storage time has the feature of this example in the place obtained by

the short time in detection mode, and the photoelectrical inverter of a high SN ratio in which the load of the operational amplifier which is high cost has two or more light optoelectric transducers can constitute it from a low cost above. In operation of the photoelectrical inverter of this example, like the 1st example, the potential of G electrode rises and Vdg falls into a photoelectrical translation mode. Although this will tend to be in the state which shows by drawing 5 (c) in the amount of incidence of a few light and it can grow into a limit of the amount of incident lights in normal operation, this can improve a capacitor 300 by enlarging enough. Conversely, it is the stray capacity CS which the optoelectric transducer 100 shown by the dotted line even if it did not constitute a capacitor 300 as a positive element, when detection of a few light was sufficient has. Work operation is possible as capacitative element. This stray capacity CS The area of the up electrode 106 of an optoelectric transducer 100 can adjust.

[0104] The plan of a photoelectrical inverter shown in drawing 15 (a) by drawing 14 and the cross section between A-B illustrated with the plan of drawing 15 (a) to drawing 15 (b) are shown. The same sign as drawing 14 shows the portion which is not illustratable in detail in drawing 15 (a). 100 is wiring with which an optoelectric transducer, and 220-222 connect TFT, and, as for a capacitor, 402, and 406, 300 connects each element electrically, and is connected through the contact hole 408. In drawing 15 (b), 412 and 416 are wiring connected to other composition sections. Drawing 15 explains the formation method of each element in order here.

[0105] First, about 500A of Cr(s) is made to deposit as a lower metal layer 2 by the spatter etc. on the glass substrate 1 which is an insulating material, patterning is carried out by the photolithography after that, and unnecessary area is **********ed. Thereby, the lower electrode of an optoelectric transducer 100, the gate electrode of TFT 220-222, the lower electrode of a capacitor 300, and the lower wiring 402 and 412 are formed.

[0106] Next, 5 (about 2000A / 5000A / 500A) is deposited a SiN 70/i layer layer [4/n-layer] within the same vacuum by CVD, respectively. These each class turns into the insulating layer / photo-electric-translation semiconductor layer / hole pouring blocking layer of an optoelectric transducer 100, the gate insulator layer / semiconductor layer / ohmic-contact layer of TFT 220-222, and an interlayer of a capacitor 300. Moreover, it is used also as a cross section insulating layer of vertical wiring. Although not only this but the voltage used as a photoelectrical inverter, current, a charge, the amount of incident lights, etc. can design the thickness of each class the optimal, SiN at least has desirable 500A or more whose function cannot pass through an electron and a hole and is possible as a gate insulator layer of TFT.

[0107] The area which becomes a contact hole 408 is **********ed after class deposition, and about 10000A of aluminum is made to deposit in a spatter etc. as an up metal layer 6 after that. Furthermore, patterning is carried out by the photolithography, unnecessary area is **********ed, and the source electrode which are the up electrode of an optoelectric transducer 100 and a main electrode of TFT 220-222 and a drain electrode, the up electrode of a capacitor 300, and the up wiring 406 and 416 are formed. By the contact hole 408, the lower wiring 402 and the up wiring 406 are connected simultaneously.

[0108] Furthermore, only the channel section of TFT 220-222 **********s n layers by RIE, 5 is **********ed a SiN 70/i layer layer [4/n layer] unnecessary after that, and each element is separated. An optoelectric transducer 100, TFT 220-222, the lower wiring 402,412, the up wiring 406,416, and a contact hole 408 are completed now.

[0109] Moreover, it usually covers the upper part of each element by passivation films, such as SiN, in order to raise endurance, although illustration has not been carried out.

[0110] It can form only by etching of 5 and the up metal layer 6, and each class at this example an optoelectric transducer 100, TFT 220-222, a capacitor 300 and the common lower metal layer 2 that the wiring section 400 deposited simultaneously, and a SiN 70/i layer layer [4/n layer] as the above explanation. Moreover, a pouring blocking layer has only one place into an optoelectric transducer 100, and it can form within the same vacuum. Furthermore, important gate insulator layer / i layer interface can also be formed within the same vacuum on the property of TFT. Furthermore, since the interlayer of

a capacitor 300 contains the insulating layer with little leak by heat, the capacitor of a good property is formed. Thus, this example is enabling production of a highly efficient photoelectrical inverter by the low cost.
The whole rough circuit diagram of thè photoelectrical inverter which [example 8] drawing 16 requires for the example of the octavus of this invention, each constituent child's typical plan with which drawing 17 (a) is equivalent to 1 pixel in this example, and drawing 17 (b) are the typical A-B cross sections of drawing 17 (a). S11-S33 show the lower electrode side by the optoelectric transducer, and show the G and up electrode side by D in drawing 16 .
[0111] On the glass substrate which is the same insulating substrate, a single tier, the shape of i.e., a line, these nine optoelectric transducers S11-S33 are arranged in single dimension, and function as the sensor section as a line sensor. The capacitor for accumulation C11-whose C33 are capacitative element, and Re11-Re33 are [the objects TFT, T11-T33 for refreshment of the objects TFT, Rf11-Rf33 for initialization] TFT for a transfer. If g, d, and s which were shown in TFT-T11 for a transfer show a gate electrode, a drain electrode, and a source electrode, respectively and make potential of a gate electrode a low battery (it is described as Following Lo), if it makes a drain electrode and source inter-electrode into un-flowing (off) and the high voltage (it is described as Following Hi), it will be in the state of a flow (on) and will function as a switching device. It is the same about other TFT in drawing.
[0112] g1-g5 are wiring for controlling each TFT, and each TFT is controlled by control pulse Hi/Lo made with a shift register SR 1. Vd it connected common to D electrode of ************** S11-S33 -- reading -- business -- a power supply and Vg It is the power supply for refreshment connected common to the drain electrode of TFT-Rf11 for refreshment - Rf33. 1 pixel consists of one optoelectric transducer, a capacitor, and three TFT, and the signal output is connected to the integrated circuit IC for detection by the matrix signal wiring MTX. The photoelectrical inverter of this example divides a total of nine pixels into three blocks, processes a 3 pixels [per block] output simultaneously, through this matrix signal wiring MTX, is changed one by one into an output by the integrated circuit IC for detection, and is outputted. M1-M3 in the integrated circuit IC for detection read, and they are controlled by Hi/Lo of the control pulse which is a switch and was made with the shift register SR 2 through the control lines sg1-sg3, and the output is connected to the integral-detection machine Amp. The integral-detection machine Amp integrates with the charge which read and has flowed in through switches M1-M3, and outputs it as Vout.
[0113] Although the portion enclosed with the drawing destructive line is formed on the same glass substrate of a large area, the plan of the portion equivalent to the 1st pixel is shown in drawing 16 (a). Moreover, the cross section of the portion shown by drawing destructive line A-B is shown in drawing 17 (b). In drawing 17 , the same sign shows the same portion as drawing 16 .
[0114] For S11, in drawing 17 (a) and (b), an optoelectric transducer, and Re11, Rf11 and T11 are [a capacitor and MTX of TFT and C11] matrix signal wiring. Drawing 17 explains the formation method of each element in order here.
[0115] First, about 500A of Cr(s) is made to deposit as a lower metal layer 2 by the spatter etc. on the glass substrate 1 which is an insulating material, patterning is carried out by the photolithography after that, and unnecessary area is **********ed. Thereby, the lower electrode of an optoelectric transducer S11, TFT-Re11, the gate electrode of Rf11 and T11, the lower electrode of a capacitor C11, and lower wiring of the matrix signal wiring MTX are formed.
[0116] Next, 5 (about 2000A / 5000A / 500A) is deposited a SiN 70/i layer layer [4/n-layer] within the same vacuum by CVD, respectively. These each class turns into the insulating layer / photo-electric-translation semiconductor layer / hole pouring blocking layer of an optoelectric transducer S11, TFT, and the gate insulator layer / semiconductor layer / ohmic-contact layer of Re11, Rf11, and T11, and an interlayer of a capacitor C11. Moreover, it is used also as a cross section insulating layer of the matrix signal wiring MTX. The thickness of each class has [SiN at least] desirable 500A or more which can be designed the optimal not only with this but with the voltage used as a photoelectrical inverter, current, a charge, the amount of incident lights, etc. and whose function cannot pass through an electron and a hole and is possible as a gate insulator layer of TFT.

[0117] The area which becomes a contact hole is **********ed after class deposition, and about 10000A of aluminum is made to deposit in a spatter etc. as an up metal layer 6 after that. Furthermore, patterning is carried out by the photolithography, unnecessary area is **********ed, and the up electrode of an optoelectric transducer S11, TFT-Re11, the source electrode that is a main electrode of Rf11 and T11 and a drain electrode, the up electrode of a capacitor C11, and up wiring of the matrix signal wiring MTX are formed. By the contact hole, lower wiring and up wiring are connected simultaneously.
[0118] Furthermore, only TFT-Re11 and the channel section of Rf11 and T11 ********** n layers by RIE, 5 is **********ed a SiN 70/i layer layer [4/n layer] unnecessary after that, and each element is separated. An optoelectric transducer S11, TFT-Re11, Rf11 and T11, the matrix signal wiring MTX, and a contact hole are completed now. As mentioned above, although the first pixel was explained, being simultaneously formed about other pixels cannot be overemphasized.
[0119] Moreover, it usually covers the upper part of each element by passivation films, such as SiN, in order to raise endurance, although illustration has not been carried out, and it pastes up an about 50 more-micron sheet glass.
[0120] It can form only by etching of 5 and the up metal layer 6, and each class at this example an optoelectric transducer, TFT, a capacitor and the common lower metal layer 2 that matrix signal wiring deposited simultaneously, and a SiN 70/i layer layer [4/n layer] as the above explanation. Moreover, a pouring blocking layer has only one place into an optoelectric transducer, and it can form within the same vacuum. Furthermore, important gate insulator layer / i layer interface can also be formed within the same vacuum on the property of TFT. Furthermore, since the interlayer of a capacitor contains the insulating layer with little leak by heat, the capacitor of a good property is formed. Next, operation of the photoelectrical inverter of this example is explained using drawing 16 or drawing 18 . Drawing 18 is a timing chart which shows operation of this example. Like the above-mentioned explanation, if the optoelectric transducer in this example is refreshed periodically, it will operate as a photosensor which outputs the photocurrent proportional to the light which carried out incidence in the photoelectrical translation mode. Operation of the block [1st] pixel in this photoelectrical inverter is explained first here.
[0121] The optoelectric transducers S11-S13 of drawing 16 presuppose that a fixed accumulation period passed after refreshment. Then, to capacitors C11-C13, the charge proportional to the integration value of the optical information which carried out incidence to this period is being accumulated. As shown in wiring g1 here at drawing 18 , the control pulse of Hi is impressed by the shift register SR 1. then, the object for a transfer -- TFT-T11-T13 will turn on and will be in switch-on if a sequential-control pulse is simultaneously impressed to the control lines sg1-sg3 by the shift register SR 2 -- the charge of capacitors C11-C13 -- the object for a transfer -- it is transmitted to the integral-detection machine Amp through TFT-T11-T13, the matrix signal wiring MTX, and the reading switches M1-M3, and is outputted to Vout one by one v1-v3 (although not illustrated, the integral-detection machine Amp is initialized before the transfer of each charge) This output is proportional to the integration value of the optical information by which incidence was carried out to optoelectric transducers S11-S13 during the fixed accumulation. Next, if a control pulse is impressed to wiring g2 as shown in drawing 18 , TFT-Rf11 for refreshment - Rf13 will flow, and G electrode of optoelectric transducers S11-S13 is the power supply Vg for refreshment. It goes up. Then, the hole in an optoelectric transducer is swept out and refreshed. If a control pulse is impressed to wiring g3 next, while TFT-Re11 for initialization - Re13 will flow and refreshment of optoelectric transducers S11-S13 will be completed, capacitors C11-C13 are initialized. If wiring g3 is set to Lo, although G electrode of optoelectric transducers S11-S13 will become open in DC, potential is held by capacitors C11-C13. It is accumulated at capacitors C11-C13 until control pulse impression of the optical information by which the accumulation period of the following period was started from here, and incidence was carried out to optoelectric transducers S11-S13 is carried out next at wiring g1, and operation is repeated below.
[0122] It operates simultaneously, the control wiring g3-g5 being wired by the control wiring g2-g4 and the 3rd block at the 2nd block, and the control pulse being impressed like drawing 18 , respectively, and

shifting each block time, although operation of the 1st block was explained so far. However, the optical information which carried out incidence to optoelectric transducers S11-S33 as v1-v9 as illustrated is outputted to Vout as a lightwave signal, without the signal of two or more blocks flowing simultaneously for the matrix signal wiring MTX, since it shifts one pulse of operation at a time and it is operating.

[0123] The part shown with the dashed line is the path (arrow) and manuscript 1000 of light in the case of reading a manuscript using the photoelectrical inverter which consisted of this examples among drawing 17 (b). A manuscript 1000 is illuminated through the aperture in the side of an optoelectric transducer from the rear face of a glass substrate 1 by Light Emitting Diode etc. Incidence is carried out to the optoelectric transducers S11-S33 with which the reflected light including the information on the character and picture which were drawn on the manuscript 1000 was located in a line in the shape of a line, and this photoelectrical inverter outputs one by one. The manuscript of one line is read to suitable amount staggering and a pan after an one-line output. This is repeated and the image information of the whole manuscript can be changed into an electrical signal. Although one line is constituted from nine pixels, 1728 pixels are arranged in in the shape of a line not only by this but by eight pixels per mm, and if it divides into 36 blocks and processes per 48 pixels, the photoelectrical inverter for A4 facsimile can consist of this examples. Thus, the photoelectrical inverter of this example makes it possible to output a lightwave signal by few control wiring and the few detector by outputting the lightwave signal of the optoelectric transducer of an nxm individual to matrix signal wiring by dividing two or more optoelectric transducers into n blocks, and controlling m TFT by the one control line simultaneously for every block. Moreover, while controlling the gate of m TFT of one block by control wiring of one, the number of control wiring is further constituted few by making the gate of m TFT of other functions of other blocks control simultaneously. It can form only by etching of 5 and the up metal layer 6, and each class at this example an optoelectric transducer, TFT, a capacitor and the common lower metal layer 2 that matrix signal wiring deposited simultaneously, and a SiN 70/i layer layer [4/n layer] as the above explanation. Thus, it is in process and a defect cannot do easily that there are few formation processes of each class, and when making the photoelectrical inverter of the pixel of a large number like especially the above-mentioned explanation, improvement in the yield is attained. Thus, this example is enabling production of a large area and a highly efficient photoelectrical inverter by the low cost.

[0124] The whole circuit diagram in which [example 9] drawing 20 shows the 9th example of the photoelectrical inverter of this invention, each constituent child's plan with which drawing 20 (a) is equivalent to 1 pixel in this example, and drawing 20 (b) are the A-B line cross sections of drawing 20 (a). In addition, the same sign is given to the portion of the same function as drawing 16 and drawing 17 . S11-S33 show the lower electrode side by the optoelectric transducer, and show the G and up electrode side by D in drawing 19 . As for C11-C33, the capacitor for accumulation, and T11-T33 are TFT for a transfer. Vs The power supply for **********, and Vg It is a power supply for refreshment and connects with G electrode of all the optoelectric transducers S11-S33 through Switches SWs and SWg, respectively. Switch SWg is directly connected to the refreshment control circuit RF through the inverter, and Switch SWs is controlled so that SWg turns on a refreshment period and SWs turns on the period of on and others. 1 pixel consists of one optoelectric transducer, a capacitor, and TFT, and the signal output is connected to the integrated circuit IC for detection by signal wiring SIG. The photoelectrical inverter of this example divides a total of nine pixels into three blocks, transmits a 3 pixels [per block] output simultaneously, through this signal wiring SIG, is changed one by one into an output by the integrated circuit IC for detection, and is outputted (Vout). Moreover, each pixel is arranged in two dimensions by arranging 3 pixels in 1 block in a longitudinal direction, and arranging 3 blocks perpendicularly in order.

[0125] Although the portion enclosed with the drawing destructive line is formed on the same insulating substrate of a large area, the plan of the portion equivalent to the 1st pixel is shown in drawing 20 (a). Moreover, the cross section of the portion shown by drawing destructive line A-B is shown in drawing 20 (b). For S11, an optoelectric transducer and T11 are [a capacitor and SIG of TFT and C11] signal wiring. In this example, a capacitor C11 and an optoelectric transducer S11 do not separate an element

specially, but form the capacitor C11 by enlarging area of the electrode of an optoelectric transducer S11. Since the optoelectric transducer and capacitor of this example are the same lamination, this is also the feature of this example in a possible thing. Although the method of forming each class is equal to the 1st example about, since it does not have a contact hole, there is no etching for the formation. Moreover, the fluorescent substances CsI, such as the silicon nitride film SiN for passivation and iodation caesium, are formed in the pixel upper part. If an X-ray (X-ray) carries out incidence from the upper part, it will be changed into light (dashed line arrow) by the fluorescent substance CsI, and incidence of this light will be carried out to an optoelectric transducer.

[0126] Next, operation of the photoelectrical inverter of this example is explained using drawing 19 or drawing 21 . Drawing 21 is a timing chart which shows operation of this example.

[0127] The control wiring g1-g3 is first impressed by shift registers SR1 and SR2, and Hi is impressed to sg1-sg3. then, the object for a transfer -- TFT-T11-T33 and switches M1-M3 turn on and flow, and D electrode of all the optoelectric transducers S11-S33 becomes GND potential (since the input terminal of the integral-detection machine Amp is designed by GND potential) The refreshment control circuit RF outputs Hi simultaneously, Switch SWg turns on, and G electrode of all the optoelectric transducers S11-S33 is the power supply Vg for refreshment. It becomes right potential. Then, all the optoelectric transducers S11-S33 become refreshment mode, and are refreshed. Next the refreshment control circuit RF outputs Lo, Switch SWs turns on, and G electrode of all the optoelectric transducers S11-S33 is the power supply Vs for reading. It becomes a negative potential. Then, all the optoelectric transducers S11-S33 become a photoelectrical translation mode, and capacitors C11-C33 are initialized simultaneously. Lo is impressed to the control wiring g1-g3, and sg1-sg3 by shift registers SR1 and SR2 in this state. then, the object for a transfer -- the switches M1-M3 of TFT-T11-T33 turn off, and although D electrode of all the optoelectric transducers S11-S33 becomes open in DC, potential is held by capacitors C11-C33 However, at this time, since incidence of the X-ray is not carried out, incidence of the light is not carried out to all the optoelectric transducers S11-S33, and a photocurrent does not flow. If outgoing radiation of the X-ray is carried out in pulse in this state, a human body etc. is passed and incidence is carried out to a fluorescent substance CsI, it will be changed into light and the light will carry out incidence to each optoelectric transducer S11-S33. As for this light, the information on internal structures, such as a human body, is included. The photocurrent which flowed by this light is accumulated as a charge at each capacitor C11-C33, and after the incidence end of an X-ray is held. next, the control pulse of Hi is impressed by the control wiring g1 with a shift register SR 1 -- having -- the control pulse impression to the control wiring sg1-sg3 of a shift register SR 2 -- the object for a transfer -- v1-v3 are outputted one by one through TFT-T11-T13 and switches M1-M3 Other lightwave signals are similarly outputted one by one by control of shift registers SR1 and SR2. Thereby, the 2-dimensional information on internal structures, such as a human body, is acquired as v1-v9. Although it is the operation so far when obtaining a static image, when obtaining a dynamic image, the operation so far is repeated.

[0128] In this example, G electrode of an optoelectric transducer is connected in common, Switch SWg and Switch SWs are minded for this common wiring, and it is the power supply Vg for refreshment. Since it is controlling to the power supply V s potential for reading, all optoelectric transducers can be simultaneously switched to refreshment mode and a photoelectrical translation mode. For this reason, complicated control can be made for there to be nothing and an optical output can be obtained by one TFT per pixel.

[0129] In this example, nine 2-dimensional pixels are arranged to 3x3, and simultaneously, 3 pixels of 40cmx40cm X-ray detectors will be obtained at a time, if not only this but 5x5 pixels per 1mm of every direction are arranged in two dimensions as 2000x2000 pixels, although it divided into 3 times and the transfer and the output of were done. If this is combined with an X-ray generator instead of an X-ray film and X-ray roentgen equipment is constituted, it can be used for a thorax roentgen medical checkup or a breast cancer medical checkup. Then, it is possible to project the output by CRT in an instant unlike a film, and it is also possible to change an output into digital one further and to change into the output which carried out the image processing by computer and which was doubled with the purpose.

Moreover, storage is also possible for a magneto-optic disk, and the past picture can also be searched in an instant. Moreover, sensitivity can also acquire a clear picture through a feeble X-ray with little [it is better than a film and] influence on a human body.
[0130] The conceptual diagram showing mounting of the detector which has 2000x2000 pixels in drawing 22 and drawing 23 is shown. In the element in the dashed line shown by drawing 19 , when it constitutes 2000x2000 detectors, although what is necessary is just to increase a number in all directions, it becomes 2000 to the control wiring g1-g2000 in this case, and signal wiring SIG is also set to sig1-sig2000 to 2000. Moreover, a shift register SR 1 and the integrated circuit IC for detection must carry out control and processing of 2000, and become large-scale. One chip becomes very large and it is disadvantageous at a yield, a price, etc. at the time of manufacture to perform this with the element of one chip, respectively. Then, a shift register SR 1 is formed in every 100-step one chip, and should just use 20 pieces (SR 1-1 - SR 1-20). Moreover, the integrated circuit for detection is also formed in every 100 processing circuit one chip, and uses 20 pieces (IC1-IC20).
[0131] 20 ******s is mounted in drawing 22 on left-hand side (L) at 20 chips (SR 1-1 - SR 1-20) and the bottom (D), and the tangent of control wiring of 100 per one chip and the signal wiring is respectively carried out to the chip by wire bonding. A drawing 22 destructive line part is equivalent to the dashed line section of drawing 19 . Moreover, the connection with the exterior is omitted. Moreover, SWg, SWs, Vg, Vs, RF, etc. are omitted. Although there is an output (Vout) of 20 from the detection integrated circuits IC1-IC20, through a switch etc., it collects into one, or these output 20 as they are and should just carry out parallel processing.
[0132] Or as shown in drawing 23 , on ten chips (SR 1-1 - SR 1-10) and right-hand side (R), you may be mounted ten chips (ICs 1-10) in ten chips (SR 1-11 - SR 1-20) and the bottom, and ten chips (ICs 11-20) may be mounted in left-hand side (L) at the bottom (D). Since this composition has distributed each wiring at a time to a top, the bottom, the left, and right-hand side (U, D, L, R) 1000, respectively, the density of wiring of each side becomes small, and its density of wire bonding of each side is also small, and its yield improves. Distribution of wiring sets to g2, g4, g6, --, g2000 in left-hand side (L) on g1, g3, g5, --, g1999, and right-hand side (R), that is, distributes left-hand side (L) and the even-numbered control to right-hand side (R) for the odd-numbered control line. If it carries out like this, since each wiring is pulled out and wired at equal intervals, its yield will improve further without concentration of density. Moreover, what is necessary is just to distribute similarly wiring to the top (U) down side (D). Moreover, although not illustrated, distribution of the wiring as another example distributes g101-g200, g301-g400, --, g1901-g2000 to left-hand side (L) on g1-g100, g201-g300, --, g1801-g1900, and right-hand side (R), that is, distributes the control line [****] the whole chip, and distributes this alternately with the left and right-hand side (L, R). If it carries out like this, it is controllable to continuation, and drive timing is easy, and does not need to complicate a circuit, and the inside of 1 chip can use a cheap thing. The same is said of a top (U) and the bottom (D), and a circuit possible [processing / ****] and cheap can be used.
[0133] Moreover, after both the examples shown in drawing 22 and drawing 23 form the circuit of the dashed line section on one substrate, they may mount a chip on the substrate and may mount the circuit board and the chip of the dashed line section on another big substrate. Moreover, a chip may be mounted on a flexible substrate, and may stick and carry out a tangent to the circuit board of the dashed line section.
[0134] Moreover, although the photoelectrical inverter of such a large area that has many pixels very much was impossible at the complicated process using the conventional photosensor, since the process of the photoelectrical inverter of this invention forms each element simultaneously by the common film, it has few processes, and since it can be managed with a simple process, the quantity yield is possible for it and it is enabling production of a large area and a highly efficient photoelectrical inverter by the low cost. Moreover, a capacitor and an optoelectric transducer can constitute within the same element, it is possible to reduce a parenchyma top element by half, and the yield can be improved further.
[0135] Next, explanation of the rush current and refreshment operation by TFT are anew explained for an understanding of this invention. Drawing 24 is the 1-bit representative circuit schematic of the

photoelectrical inverter which consists of TFT1700 and a power supply 1115, and drawing 25 is the timing chart which shows the operation.
[0136] Here, in order to simplify explanation, it explains using the 1-bit representative circuit schematic of the photoelectrical inverter shown in drawing 24 which is the case where an electropositive potential is given to G electrode of an optoelectric transducer through TFT1700. And the potential of D electrode of an optoelectric transducer is VD by the power supply 114. It shall be designed and the potential of G electrode at the time of refreshment operation shall be set as VrG by the power supply 1115.
[0137] An optoelectric transducer 100 is explained below here, referring to with drawing 1 (a), since it is the same composition as the optoelectric transducer 100 shown in the example 1 mentioned above.
[0138] If the potential (VO) of G electrode of an optoelectric transducer 100 is refreshed more than the potential (VD) of D electrode as shown in drawing 1 (a) (VO =VrG>=VD), all the holes by which the trap was carried out to the hole and the interface defect whose i layers exist in the interface of 4 and an insulating layer 70 which had stopped in i layer 4 of an optoelectric transducer 1100 will be completely swept out by D electrode. Conversely, an electron flows in into i layer 4 from D electrode at this time, and the trap of the part is carried out to the interface defect whose i layers exist in the interface of 4 and an insulating layer 70. This current is called negative rush current below. And after a refreshment operation end, when initializing the potential of G electrode of an optoelectric transducer 100 to GND potential etc., all the electrons by which the trap was carried out to the inside of i layer 4 and the interface defect are swept out to D electrode. This current is called positive rush current below. Generally the energy which the interface defect whose i layers exist in the interface of 4 and an insulating layer 70 makes move an electron and a hole to an interface defective position from the energy to which the electron and hole which exist in an interface defective position since an energy level is deep are moved, and other positions is relatively high, and the mobility on appearance also becomes low. For the reason, even if it becomes this thing from dozens microseconds several seconds and G electrode reset action is completed until the positive rush current becomes zero (i.e., until all the electrons by which the trap was carried out to the interface defect are swept out to D electrode), the big rush current flows. Consequently, in the charge accumulated at the capacity which G electrode has, the charge by the rush current which is a noise component will be included, and the charge part SN ratio will fall as a result.
[0139] It uses with drawing 24 and drawing 25 further, and the above-mentioned reason is explained in detail.
[0140] Pa, Pb, Pc, and Pd of drawing 25 show the timing of a high-level pulse which drives the switching device 1125 in drawing 24 , TFT1300 for a transfer, TFT1700 for refreshment, and TFT1400 for reset respectively. H shows the high level which makes each driver element an ON state, and, generally +8-+15V place is used by +5V-+12V and a-SiTFT with a crystal silicon solid state switch element here. Moreover, generally as for L, many 0V are used. IS VO As the arrow in drawing 24 shows, in the state where a fixed signal light was respectively irradiated by the optoelectric transducer 100, the potential of the current and G electrode which flow in the direction of an arrow is shown. information separator [pulse width / of Pa-Pd] at the time of operation of 20 microseconds in here VO It is shown in drawing 25 .
[0141] It sets to drawing 25 and is VO. It is maintained at high potential fixed from the pulse standup for refreshment of Pc to the pulse standup for reset of Pd. For the reason, it did not generate in the meantime but the positive rush current of the electron by which the trap was carried out to the interface defect mentioned above for the first time at the time of the pulse standup of Pd considered to depend for sweeping out has generated the positive rush current. In order to cut in about 80 to 100 microsecond with the equipment which we produced until this positive rush current declines and it becomes zero mostly, at the time of falling of the pulse of Pd which begins to accumulate a signal charge in the capacity which G electrode has, the positive rush current has occurred mostly and the charge and voltage value of a portion which were shown with the slash in drawing will be accumulated as a noise component. As a result, the accumulation part SN ratio will fall. Although it is possible to lengthen time of the pulse for reset of Pd as a method of reducing the positive rush current, by there being a limitation

also in the time and lengthening time, the signal reading time of the whole equipment becomes long, and will cause, low-speed-izing, i.e., a performance down, of equipment.
[0142] Next, the conditions of the applied voltage at the time of making an optoelectric transducer 100 refresh using drawing 26 are explained.
[0143] Drawing 26 is the energy-band view of an optoelectric transducer 100, and each electrode (D electrode and G electrode) of ends is in an open (open) state. A large state (AKYUMURESHON state) appears [full capacity / a small state (depression state) and small full capacity] relatively according to the voltage conditions which an optoelectric transducer 100 is MIS (Metal-Insulator-Semiconductor) structure generally said, and join the electrode of ends.
[0144] Although the ends of each device in drawing 26 are open, about an energy-band view, the case of drawing 26 (b) is the same as the energy-band view of the above-mentioned depression state, and the case where it is drawing 26 (c) is the same as the energy-band view of an AKYUMURESHON state.
[0145] Generally an MIS capacitor is in a depression state (3 V>=VFB>0V) in many cases immediately after production the state (flat-band-voltage VFB=0V), i.e., a flat band [of i layers] state, of drawing 26 (a), or the state, i.e., a little, of drawing 26 (b). Moreover, VFB can also be made to some extent arbitrary positive and negative values by applying voltage to the ends of an MIS capacitor.
[0146] By the above thing, the conditions of a voltage value of bringing about the positive rush current (the damping time being long and current value being size) are summarized to below.
[0147] first -- if the potential (VrG) of G electrode at the time of refreshment is higher than the potential (VD) of D electrode when the flat band voltage VFB of i layers of an optoelectric transducer 100 is zero -- namely, VrG>VD it is -- if -- the positive rush current flows
[0148] Moreover, if equivalent or the potential (VrG) of G electrode at the time of refreshment is higher than the voltage value which deducted VFB from the potential (VD) of D electrode, when the flat band voltage VFB of i layers of an optoelectric transducer 100 is not zero (i.e., if it is VrG>=VD-VFB), the positive rush current will flow.
[0149] The above-mentioned mechanism is explained using drawing 27 .
[0150] Drawing 27 expresses the state of the thickness direction of each class from the lower electrode layer 2 of drawing 27 (a) to the transparent-electrode layer 6 in the energy-band view of the optoelectric transducer 1100 in VrG>=VD-VFB. In drawing 27 (a) of refreshment operation, the hole where D electrode was shown by the black dot in i layer 4 since the electronegative potential was given to G electrode is led to D electrode by electric field. i layers of electrons shown with a circle [white] simultaneously are poured into 4. Moreover, a part spends a certain amount of [conversely] time among the electrons which spent a certain amount of [the hole by which the trap was carried out to the interface defect of 4 and an insulating layer 70 i layers] time, were led to D electrode, and were poured into 4 i layers, and the trap of the i layers is carried out to the interface defect of 4 and an insulating layer 70. n-layer 5 or i layers, at this time, in 4, some of holes and electrons are recombined and disappear. If this state continues time long enough, the hole in i layer 4 will be swept out from 4 i layers. Since, as for D electrode, an electropositive potential will be given to G electrode if it becomes drawing 27 (b) of photo-electric-translation operation in this state, the electron in i layer 4 is led to D electrode in an instant. And the electron by which the trap was carried out to the interface defect of 4 and an insulating layer 70 i layers spends between a certain degree degree hours, and is led to D electrode. It is the cause of the rush current in question which the electron by which the trap was carried out to this interface defect mentioned above. A hole is not led to 4 i layers here, in order that 5 [n-layer] may work as a pouring blocking layer. If light carries out incidence into i layer 4 in this state, light will be absorbed and an electron and a hole pair will generate it. This electron is led to D electrode by electric field, and a hole moves in the inside of i layer 4, and gives i layers to the interface of 4 and an insulating layer 70. However, since it cannot move into an insulating layer 70, it will stop in i layer 4. And the trap of some holes is carried out to an interface defect. And the state after maintaining drawing 27 (b) of a certain period photo-electric-translation operation is drawing 27 (c).
[0151] Hereafter, other examples of this invention are explained in detail based on a drawing.
[0152] [Example 10] drawing 28 is the rough representative circuit schematic of 1 bit of the

photoelectrical inverter concerning the 10th example of this invention. Drawing 29 is a timing chart when actually driving the photoelectrical inverter of drawing 28 .
[0153] Since the thing same about the portion shown by the same number as drawing 24 in drawing 28 is shown, explanation is omitted. The difference from the rough equal circuit and this example which are shown in drawing 24 is the size of the power supply connected to TFT1700.
[0154] In addition, since the photoelectrical transducer 100 is carrying out the same structure as drawing 4 (a), the pouring blocking layer between i layers and the 2nd electrode layer is an n type semiconductor layer, and the carrier with which pouring is prevented is a hole here. If the charge of one carrier with which pouring is prevented is set to q for the reason, it will be set to q> 0 in this case.
[0155] In addition, in this example, the signal-detection section includes the detection means in the dotted line of drawing 28 , TFT1300, and a means to impress the high-level pulse Pb.
[0156] A different point from drawing 24 in drawing 28 is the potential VD of the power supply 114 which gives an electropositive potential to D electrode for the potential VrG of the power supply 1115 which gives an electropositive potential to G electrode in refreshment operation of an optoelectric transducer 100. It is only the point which is compared and is made low. Since the flat band voltage (VFB) impressed to G electrode exists in an optoelectric transducer 100 in order to make the energy band of i layers into a flat if it says in detail, by this example of drawing 28 , it drives in the state of VrG<VD-VFB in fact to having driven in the state of VrG>=VD-VFB in the example of drawing 24 .
[0157] Next, operation of the photoelectrical inverter of this example is explained in drawing 29 .
[0158] A different point from drawing 25 in drawing 29 is current information separator of an optoelectric transducer 100. Current information separator Potential VO of G electrode to depend It is behavior.
[0159] In drawing 29 , the refreshment pulse of Pc starts, and if voltage VrG (VrG<VD-VFB) is impressed to G electrode of the photoelectrical transducer 100, a part of hole which had stopped in i layers of the photoelectrical transducer 100 will be swept out by D electrode. At this time, all are mostly considered to be in the state as it is of the hole by which the trap was carried out to the interface defect of i layers and an insulating layer. Moreover, although the amount or the quantity not more than it equivalent to some holes where the electron was swept out by D electrode flows in into i layers from D electrode at this time, the potential by the side of G electrode is considered that the electron by which the trap of the electric field in i layers is carried out to the interface defect of i layers and an insulating layer for a low reason is zero mostly. Therefore, information separator in drawing 29 The damping time is also short, without producing only the negative small rush current at the time of the refreshment pulse standup of Pc. Moreover, voltage V0 of G electrode from the refreshment pulse standup of Pc to G electrode reset pulse standup of Pd It is mostly in agreement with VrG, and drawing 29 shows that the potential has fallen from VD-VFB.
[0160] Next, G electrode reset pulse starts, and when G electrode of the photoelectrical transducer 100 is grounded by GND, some electrons of all that had stopped in i layers will flow into D electrode. Since an electron does not exist in the interface defect of i layers and an insulating layer at this time, it is thought that an electron is little and flows out in an instant. Moreover, it is thought that it hardly moves in the hole which exists in an interface defect at this time. Therefore, it sets at the time of G electrode reset pulse standup of Pd, and is information separator. The damping time is also short, without producing only the positive small rush current. If from the standup of G electrode reset pulse of Pd to falling is operated by about 20 microseconds, at the time of falling of the pulse of Pd which serves as a photo-electric-translation operation start as shown in drawing, the rush current will become zero mostly. Therefore, the charge which begins to be accumulated from falling of the pulse of Pd becomes able [all] to acquire the information that an SN ratio is high, by becoming a charge by the signal light which carried out incidence into the photoelectrical transducer 100, and reading the signal level mostly. Although the capacitor 1124 for read-out and the switching device 1125 for potential initialization can be omitted when not accumulating a signal charge to the capacitor 1124 for read-out but reading with an ammeter etc., this is [that especially the element for the signal detections in the square dotted line shown in drawing 28 here is not limited, and just detects current or a charge with a direct or integration

value] the same as having stated by previous explanation.
[0161] Hereafter, the fundamental mechanism in the 10th example of this invention is further explained to a detail using drawing.
[0162] Drawing 30 (a) - drawing 30 (c) are the energy-band views showing operation of the photoelectrical transducer 100 in VrG<VD-VFB, and correspond to the energy-band view shown in drawing 27 (a) - drawing 27 (c).
[0163] Since, as for D electrode, the electropositive potential is given to G electrode in drawing 30 (a) of refreshment operation, a part of hole shown by the black dot in i layer 4 is led to D electrode by electric field. i layers of electrons shown with a circle [white] simultaneously are poured into 4. It hardly moves in the hole by which the trap was carried out to the interface defect of 4 and an insulating layer 70 i layers here, and the trap of the electron is not carried out to an interface defect.
[0164] Since the electron by which the trap was carried out to the interface defect hardly exists, the rush current which poses a problem by the photoelectrical inverter of drawing 24 explained previously stops almost existing, although the electron in i layer 4 will be led to D electrode in an instant since, as for G electrode, a still bigger electronegative potential is given to D electrode, if it becomes drawing 30 (b) of photo-electric-translation operation in this state.
[0165] And it becomes drawing 30 (c) of the state after maintaining drawing 30 (b) of a certain period photo-electric-translation operation.
[0166] Thus, in this example, spending long time of i layers of electrons existing in the interface defect of 4 and an insulating layer 70 on electronic receipts and payments, since there is almost nothing is lost, and it becomes possible to cut down greatly the rush current which serves as a noise component as a result.
[0167] The 11th example is explained using drawing 32 from [example 11] drawing 31 . Drawing 31 is the rough representative circuit schematic of a photoelectrical inverter showing the 11th example of this invention. However, the case of the optoelectric-transducer array which has nine optoelectric transducers arranged in single dimension here is taken up as an example.
[0168] Drawing 32 is the typical plan showing 1 pixel among the groups of the photoelectrical transducer 100 which has two or more pixels in the direction of a long picture, the TFT section 1700 for refreshment, the TFT section 1300 for a transfer, the TFT section 1400 for reset, and the wiring section 1500.
[0169] In drawing 32 , the photoelectrical transducer 100 has the lower electrode 2 which served as the shading film to the light from a substrate side. It reflects in respect of the manuscript located in the perpendicular upper part to a drawing through the aperture 17 for lighting (un-illustrating), and the reflected light carries out incidence of the light irradiated from the substrate side to an optoelectric transducer 100. The photocurrent by the carrier generated here is accumulated at the equivalence capacity component of an optoelectric transducer 100, and other stray capacity. The accumulated charge is transmitted to the matrix wiring section 500 for signal lines by TFT300 for a transfer, and is read by the signal-processing section (un-illustrating) as voltage.
[0170] Especially the 2nd electrode layer is not made into the transparent electrode here. Moreover, in an example, the pouring blocking layer between i layers and the 2nd electrode layer is n type, and the carrier with which pouring is prevented is a hole. If the charge of one carrier with which pouring is prevented is set to q for the reason, it will be set to q> 0 also in this case.
[0171] Next, the drive method of the photoelectrical inverter which is the example of **** 11 is explained using a circuit diagram.
[0172] In drawing 31 , an optoelectric transducer S1 - S9 constitute 1 block from three pieces, and constitute the optoelectric-transducer array from 3 blocks. the object for refreshment respectively connected corresponding to an optoelectric transducer S1 - S9 -- TFT-F1-F9, TFT-R1-R9 which initialize G electrode potential of an optoelectric transducer S1 - S9, and the object for a signal-charge transfer -- the same is said of TFT-T1-T9
[0173] moreover, the individual electrode which has the same turn within each block of an optoelectric transducer S1 - S9 -- the object for an each transfer -- it connects with one of the highways 1102-1104

through TFT-T1-T9 If it says in detail, 1st TFT-T1 for a transfer of each block, 2nd TFT-T2 for a transfer of each block of T4 and T7 in a highway 1102, and T5 and T8 are connected to T6, and a highway 1103 and 3rd [of each block] TFT-T3 for a transfer and T9 are respectively connected to the highway 1104. Highways 1102-1104 are respectively connected to amplifier 1126 through switching transistors T100-T120.
[0174] Moreover, in drawing 3 , highways 1102-1104 are respectively grounded through the common capacitors C100-C120, and are grounded through switching transistors CT1-CT3. Here, by connecting in common and considering as an ON state to the same timing as the pulse of Pa shown by drawing 29 , each gate electrode of switching transistors CT1-CT3 discharges the residual charge of highways 1102-1104 to GND, and initializes potential. In addition, in this example, a refreshment means has TFT-F1-F9, a shift register 1108, a power supply 1115, and a power supply 114, and the signal-detection section contains the detection means in the dotted line of drawing 31 , TFT-T1-T9, and a shift register 1106.
[0175] Next, operation of the example of **** 11 is explained serially.
[0176] First, if signal light carries out incidence to an optoelectric transducer S1 - S9, according to the intensity, a charge will be accumulated at the equivalence capacity component and each stray capacity of each photoelectrical transducer 100. and high level outputs from the 1st parallel terminal of a shift register 1106 -- having -- the object for a transfer -- the charge by which TFT-T1-T3 were accumulated by the ON state and the bird clapper at each capacity component and each stray capacity is transmitted to the each common capacitors C100-C120 Then, the high level outputted from a shift register 1107 will shift, and switching transistors T100-T120 will be in an ON state one by one. The block [1st] lightwave signal transmitted to the common capacitors C100-C120 is read one by one by this through amplifier 1126.
[0177] the object for a transfer -- after TFT-T1-T3 are turned off, high level outputs from the 1st parallel terminal of a shift register 1108 -- having -- the object for refreshment -- TFT-F1-F3 will be in an ON state and the potential of G electrode of optoelectric transducers S1-S3 rises At this time, the potential VrG of a power supply 1115 is the potential VD of a power supply 114. And if the greatest flat band voltage VFB of all the optoelectric transducers S1 - S9 is used, it will be set as the relation of VrG<VD-VFB. And a part of hole in an optoelectric transducer S1 - S3 is swept out by the common power supply line 1403.
[0178] next, high level outputs from the 1st parallel terminal of a shift register 1109 -- having -- the object for reset -- the potential of G electrode of optoelectric transducers S1-S3 is initialized by GND by making TFT-R1-R3 into an ON state And next, the potential of the common capacitors C100-C120 is initialized by the pulse of Pa. When the potential of the common capacitors C100-C120 is initialized completely, a shift register 1106 shifts, and high level is outputted from the 2nd parallel terminal. thereby -- the object for a transfer -- TFT-T4-T6 are turned on and the signal charge accumulated at block [2nd] the equivalent capacity component and stray capacity of optoelectric-transducer S4-S6 is transmitted to the common capacitors C100-C120 And like the case of the 1st block, switching transistors T100-T120 will be in an ON state one by one, and the block [2nd] lightwave signal accumulated at the common capacitors C100-C120 is read one by one by the shift of a shift register 1107.
[0179] In the 3rd block, charge transfer operation and read-out operation of a lightwave signal are performed similarly.
[0180] Thus, by a series of operation from the 1st block to the 3rd block, reading the signal for one line in the main scanning direction of a manuscript is completed, and the read signal is outputted by the size of the reflection factor of a manuscript, i.e., the size of the amount of incident lights, in analog.
[0181] Moreover, in the above 10th and explanation of the 11th example, you may constitute a hole and an electron conversely. For example, ****** [the number of pouring blocking layers / p]. In this case, the direction which voltage and electric field impress in the above 10th and the 11th example is made reverse, and if other portions are constituted similarly, the same result of operation as the above-mentioned example will be obtained. In such a case, the charge q of one carrier with which pouring is prevented by the pouring blocking layer is set to q< 0.

[0182] Moreover, although the 11th example of the above explained the single dimension-line sensor, it is [be / possible / composition] needless to say in a bird clapper by becoming a-like 2-dimensional area sensor, if two or more line sensors are arranged, and using the block division drive which also showed the photoelectrical inverter which performs actual size reading of X-ray image pck-up equipment etc. in the above-mentioned example.
[0183] As explained above, since in addition to the 10th example an optoelectric transducer, TFT, and the matrix signal wiring section are the same film composition and the 11th example can be simultaneously formed in the same process, the miniaturization and quantity yield of it become possible, and it can realize the photoelectrical inverter of the high SN ratio in a low cost.
[0184] [Example 12] drawing 33 is the rough representative circuit schematic of 1 bit of the photoelectrical inverter of this example, and drawing 34 is a timing chart explaining the example in the case of driving the photoelectrical inverter of drawing 33 .
[0185] In drawing 33 , the thing of the same number as drawing 28 shows the same member. In drawing 33 , one electrode of a capacitor 1200 is electrically connected to the photoelectrical transducer 100 instead of TFT1700 of drawing 28 , and the electrode of another side of a capacitor 1200 is connected to the pulse generating means Pc for refreshment.
[0186] A capacitor 1200 functions as a capacity means for pulse impression to give an electropositive potential to G electrode in refreshment operation of the photoelectrical transducer 100.
[0187] Moreover, 1300 is TFT which transmits a signal charge in detection operation, and 1400 is TFT for initialization which initializes the potential of G electrode. Moreover, the inside of a square dotted line expresses the signal-detection section, and being constituted by IC etc. is common and it shows it as one example in drawing 33 . The switching device to which 1124 initializes the capacitor for read-out and 1125 initializes the capacitor 1124 for read-out here, and 1126 are operational amplifiers. The signal-detection section is not limited to this example, and just detects current or a charge with a direct or integration value. For example, when not accumulating a signal charge to the capacitor 1124 for read-out but reading with an ammeter etc., the capacitor 1124 for read-out and the switching device 1125 for potential initialization can be omitted.
[0188] Hereafter, an example of operation of the photoelectrical inverter of this example is explained using drawing 34 .
[0189] In refreshment operation of an optoelectric transducer, as shown in drawing 34 , only when the high-level pulse of Pc is added by adding the high-level pulse Pc for refreshment to the G electrode [of a capacitor 1200], and electrode side which counters, it constitutes so that the potential of G electrode may rise. The hole which had stopped in the photoelectrical transducer 100 for the reason is swept out by D electrode, and the photoelectrical transducer 100 is refreshed. then, D electrode of the hole which had stopped into the photoelectrical transducer 1100 since the potential of G electrode which is a counterelectrode of a capacitor 1200 also fell in an instant at the same time the refreshment pulse of Pc falls -- it sweeps, **** is completed and it becomes photo-electric-translation operation In order for the positive rush current as shown in drawing 34 to occur in the photoelectrical transducer 1100 and to decrease gradually to it in fact, after the rush current flows, photo-electric-translation operation is begun. Next, TFT1400 will be in an OFF state by the low voltage (henceforth low level) pulse of Pd, and G electrode becomes open in direct current. However, potential is kept actual by the capacity of a capacitor 1200, and equivalence-the capacity component and stray capacity of the photoelectrical transducer 1100. As for the potential of G electrode to an outflow G electrode, the current which corresponds if the lightwave signal of the photoelectrical transducer 1100 is carrying out incidence here goes up. That is, the incidence information on light is accumulated as a charge at the capacity which G electrode has. Although fixed TFT1300 for a transfer after the storage time is turned on from an OFF state by the high-level pulse of Pb and the accumulated charge flows to a capacitor 1124, this charge is a value proportional to the integration value of the current which flowed out of the photoelectrical transducer 100 in photo-electric-translation operation, that is, is detected by the detecting element through an operational amplifier 1126 as a total amount of the incidence of light. Moreover, as for the potential of a capacitor 1124, before this transfer operation, it is desirable to be initialized by GND potential by the

high-level pulse of Pa of TFT1125. And if TFT1300 for a transfer is turned off, TFT1700 for refreshment will be in an ON state by the high-level pulse of Pc again, and a series of operation will be repeated below. In addition, the signal-detection section includes the detection means in the dotted line of drawing 30 , TFT1300, and a means to impress the high-level pulse Pb, including a means by which a refreshment means impresses a capacitor 1200 and the high-level pulse Pc in this example, and a power supply 114.

[0190] In this example, in refreshment operation, the electropositive potential was given to G electrode of an optoelectric transducer through the capacitor 1200, and the positive rush current at the time of accumulation of a signal charge is prevented.

[0191] Although it is possible to lengthen time of the initialization pulse of Pd as a method of reducing the positive rush current, by there being a limitation also in the time and lengthening time, the signal reading time of the whole equipment becomes long, and will cause, low-speed-izing, i.e., a performance down, of equipment.

[0192] Then, when from falling of the pulse of Pc to falling of G electrode potential initialization pulse of Pd is operated in about 100micro second by a capacitor's performing refreshment operation and performing a suitable timing setting in this example, it is V0 as shown in drawing 34 . The rush current which are accumulated by carrying out becomes zero mostly. Therefore, the charge which begins to be accumulated from falling of the pulse of Pd becomes able [all] to acquire the information that an SN ratio is high, by becoming a charge by the signal light which carried out incidence into the photoelectrical transducer 100, and reading the signal level mostly. Moreover, the potential V0 (refresh) of G electrode when impressing the high-level pulse (Vres) of Pc is calculated. It is CX about the capacity of C0 and a capacitor 1200 in the sum of the stray capacity connected to G electrode, and the equivalence capacity component of an optoelectric transducer 1100. When it carries out, V0 (refresh) is expressed with the following formula.

[0193]

Capacitor CX which 0(refresh)-=[V] {CX-/(C-0-+-CX)}-x-Vres-twists, and is made V0 (refresh) can be freely changed with a size, and the flexibility when actually designing also increases.

[0194] Where the positive rush current is set to about 0 by giving an electropositive potential to G electrode of an optoelectric transducer through a capacitor 1200, a signal charge can be accumulated so that clearly from having stated above.

[0195] The 2nd electrode layer is not made into the transparent electrode here. Moreover, the pouring blocking layer between i layers of the photoelectrical transducer 100 and the 2nd electrode layer is n type, and the carrier with which pouring is prevented is a hole. If the charge of one carrier with which pouring is prevented for the reason is set to q, it will be set to q> 0 in this case.

[0196] Moreover, in explanation of this example, you may constitute a hole and an electron conversely. For example, ****** [the number of pouring blocking layers / P]. In this case, the direction which voltage and electric field impress in this example is made reverse, and if other portions are constituted similarly, the same result of operation as the above-mentioned example will be obtained. In such a case, the charge q of one carrier with which pouring is prevented by the pouring blocking layer is set to q< 0.

[0197] The 13th example of this invention is explained using drawing 37 from [example 13] drawing 35 .

[0198] Drawing 35 is the rough representative circuit schematic of the photoelectrical inverter for explaining the 13th example of this invention. However, the case of the optoelectric-transducer array which has nine optoelectric transducers arranged in single dimension here is taken up as an example. Drawing 36 is the typical plan showing 1 pixel among the groups of the optoelectric-transducer section which has two or more pixels in the direction of a long picture, the capacitor section for refreshment, the TFT section for a transfer, the TFT section for reset, and the wiring section. Drawing 37 is a 1-pixel cross section. In addition, drawing 37 is typically drawn, in order to make it easy to understand, and the position of the wiring section is not necessarily in agreement with drawing 36 . Moreover, the TFT section 1400 for reset is not illustrated. Moreover, in drawing 37 , the same sign is given to the same portion as drawing 33 from drawing 35 .

[0199] In drawing 36 , the photoelectrical transducer 100 has the lower electrode layer 2 which served as the shading film to the light from a substrate side. It reflects in respect of the manuscript located in the perpendicular upper part to a drawing through the aperture 17 for lighting (un-illustrating), and the reflected light carries out incidence of the light irradiated from the substrate side to the photoelectrical transducer 100. The photocurrent by the carrier generated here is accumulated at the equivalence capacity component of the photoelectrical transducer 100, and other stray capacity. The accumulated charge is transmitted to the matrix wiring section 1500 for signal lines by TFT1300 for a transfer, and is read by the signal-processing section (un-illustrating) as voltage.
[0200] In drawing 37, the lamination of each part is explained briefly.
[0201] For 100 in drawing, as for the capacitor for refreshment, and 1300, a photoelectrical transducer and 1200 are [TFT for a transfer and 1500] the wiring sections, and these are constituting a total of the 1st electrode layer 2-1, 2-2, 2-3, 2-4, and common 70 or i layer five-layer layer of insulating layers that consists of 5, the 2nd electrode layer 6-1, 6-2, 6-3, and 6-4 4 or n layers Especially the 2nd electrode layer is not made into the transparent electrode here.
[0202] Moreover, also in this example, since the photoelectrical transducer 100 is carrying out the same structure as the 1st example, i layers of pouring blocking layers between 4 and the 2nd electrode layer 6-1 are n type, and the carrier with which pouring is prevented is a hole. If the charge of one carrier with which pouring is prevented is set to q for the reason, it will be set to q> 0 also in this case.
[0203] Next, the drive method of the photoelectrical inverter of this example is explained using drawing 35.
[0204] In drawing 35, an optoelectric transducer S1 - S9 constitute 1 block from three pieces, and constitute the optoelectric-transducer array from 3 blocks. TFT-R1-R9 which initialize G electrode potential of the capacitors C1-C9 for refreshment respectively connected corresponding to an optoelectric transducer S1 - S9, an optoelectric transducer S1 - S9, and the object for a signal-charge transfer -- the same is said of TFT-T1-T9
[0205] moreover, the individual electrode which has the same turn within each block of an optoelectric transducer S1 - S9 -- the object for an each transfer -- it connects with one of the highways 1102-1104 through TFT-T1-T9 If it says in detail, 1st TFT-T1 for a transfer of each block, 2nd TFT-T2 for a transfer of each block of T4 and T7 in a highway 1102, and T5 and T8 are connected to T6, and a highway 1103 and 3rd [of each block] TFT-T3 for a transfer and T9 are respectively connected to the highway 1104. Highways 1102-1104 are respectively connected to amplifier 1126 through switching transistors T100-T120.
[0206] Moreover, in drawing 35, highways 1102-1104 are respectively grounded through the common capacitors C100-C120, and are grounded through switching transistors CT1-CT3. Here, by connecting in common and considering as an ON state to the same timing as the pulse of Pa shown by drawing 34, each gate electrode of switching transistors CT1-CT3 discharges the residual charge of highways 1102-1104 to GND, and initializes potential.
[0207] In addition, in a refreshment means, in this example, the signal-detection section contains the detection means in the dotted line in drawing 35, TFT-T1-T9, and a shift register 1106 including capacitors C1-C9, a shift register 1108, and a power supply 1114.
[0208] Next, operation of this example is explained serially.
[0209] First, if signal light carries out incidence to an optoelectric transducer S1 - S9, according to the intensity, a charge will be accumulated from a power supply 114 at the equivalence capacity component and each stray capacity of the capacitors C1-C9 for refreshment, and each photoelectrical transducer 100. and high level outputs from the 1st parallel terminal of a shift register 1106 -- having -- the object for a transfer -- the charge by which TFT-T1-T3 were accumulated by the ON state and the bird clapper at the capacitors C1-C3 for refreshment, each capacity component, and each stray capacity is transmitted to the each common capacitors C100-C120 Then, the high level outputted from a shift register 1107 will shift, and switching transistors T100-T120 will be in an ON state one by one. The block [1st] lightwave signal transmitted to the common capacitors C100-C120 is read one by one by this through amplifier 1126.

[0210] the object for a transfer -- after TFT-T1-T3 are turned off, high level is outputted from the 1st parallel terminal of a shift register 1108, and the potential of the ends of the capacitors C1-C3 for refreshment rises And the hole in an optoelectric transducer S1 - S3 is swept out by the common power supply line 1403.
[0211] next, high level outputs from the 1st parallel terminal of a shift register 1109 -- having -- the object for reset -- the potential of G electrode of optoelectric transducers S1-S2 is initialized by GND by making TFT-R1-R3 into an ON state And next, the potential of the common capacitors C100-C120 is initialized by the pulse of Pa. When the potential of the common capacitors C100-C120 is initialized completely, a shift register 1106 shifts, and high level is outputted from the 2nd parallel terminal. thereby -- the object for a transfer -- TFT-T4-T6 are turned on and the signal charge accumulated at the block [2nd] capacitors C4-C6 for refreshment, stray capacity, and an equivalent capacity of a sensor is transmitted to the common capacitors C100-C120 And like the case of the 1st block, switching transistors T100-T120 will be in an ON state one by one, and the block [2nd] lightwave signal accumulated at the common capacitors C100-C120 is read one by one by the shift of a shift register 1107.
[0212] In the 3rd block, charge transfer operation and read-out operation of a lightwave signal are performed similarly.
[0213] Thus, by a series of operation from the 1st block to the 3rd block, reading the signal for one line in the main scanning direction of a manuscript is completed, and the read signal is outputted by the size of the reflection factor of a manuscript in analog.
[0214] Although an optoelectric transducer, the capacitor for refreshment, TFT for a transfer, TFT for reset, and the matrix signal wiring section have the composition of a total of the five-layer common layer which has the 1st electrode layer, an insulating layer, i layers, n layers, and the 2nd electrode layer as drawing 37 explained in the above-mentioned this example No element sections not necessarily need to be the same lamination, an optoelectric transducer is this structure (MIS structure) at least, and if other element sections are lamination equipped with the function as each element, they are enough. However, the same lamination is convenient because of improvement in the yield, and low-cost-izing.
[0215] Moreover, in explanation of the above-mentioned this example, you may constitute a hole and an electron conversely. For example, ****** [the number of pouring blocking layers / P]. In this case, the direction which voltage and electric field impress in the above-mentioned this example is made reverse, and if other portions are constituted similarly, the same result of operation as the above-mentioned example 1 will be obtained. In such a case, the charge q of one carrier with which pouring is prevented by the pouring blocking layer is set to $q< 0$.
[0216] Moreover, although the above-mentioned this example explained the single dimension-line sensor, it is [be / possible / composition] needless to say in a bird clapper by becoming a two-dimensional area sensor, if two or more line sensors are arranged, and using the block division drive which also showed the photoelectrical inverter which performs actual size reading of X-ray image pck-up equipment etc. in the above-mentioned example.
[0217] As explained above, since an optoelectric transducer, TFT, and the matrix signal wiring section are the same film composition and this example can be simultaneously formed in the same process, the miniaturization and quantity yield of it become possible, and it can realize the photoelectrical inverter of the high SN ratio in a low cost.
[0218] The optoelectric transducer of this example is not limited to what was shown in the example so that clearly from the above explanation. That is, there are an insulating layer which prevents the 1st electrode layer, hole, and electron transfer, a photo-electric-translation semiconductor layer, and the 2nd electrode layer, and there should just be a pouring blocking layer which pouring of the hole to a photo-electric-translation semiconductor layer prevents between the 2nd electrode layer and a photo-electric-translation semiconductor layer. Furthermore, the photo-electric-translation semiconductor layer should just have the photoelectrical converter ability which light carries out incidence and generates an electron and a hole pair. Lamination may not come out further, either, and may be constituted from a multilayer, and the property may be changing continuously.

[0219] In TFT, there should just be a gate electrode, a gate insulator layer, a semiconductor layer in which channel formation is possible, an ohmic-contact layer, and a main electrode similarly. For example, there ****** p ohmic-contact layers, make voltage of control of a gate electrode reverse in this case, and should just use a hole as a carrier.
[0220] Moreover, the composition used also [polar zone / of each element] that there should just be an interlayer who contained the lower electrode layer and the insulating layer also in the capacitor, and an up electrode layer similarly even if it carried out special separation neither with an optoelectric transducer nor TFT may be used.
[0221] Furthermore, not all insulating substrates also need to be insulators and the insulator could deposit them on the conductor or the semiconductor.
[0222] Moreover, for a certain reason, the function to store a charge in the optoelectric transducer itself can also acquire the integration value of the optical information on a fixed period without a special capacitor.
[0223] The photoelectrical inverter of a rough equivalent view shown in drawing 33 explained in the [example 14] example 13 can be driven to the timing shown in the timing chart shown in drawing 38.
[0224] Hereafter, operation of the photoelectrical inverter which is this example is explained using drawing 38.
[0225] In refreshment operation of an optoelectric transducer, as shown in drawing 38, only when the high-level pulse of Pc is added by adding the high-level pulse Pc for refreshment to the G electrode [of a capacitor 1200], and electrode side which counters, it constitutes so that the potential of G electrode may rise. The hole which had stopped in the photoelectrical transducer 100 for the reason is swept out by D electrode, and the photoelectrical transducer 100 is refreshed.
[0226] then, D electrode of the hole which had stopped into the photoelectrical transducer 100 since the potential of G electrode which is a counterelectrode of a capacitor 1200 also fell in an instant at the same time the refreshment pulse of Pc falls -- it sweeps, **** is completed and it becomes photo-electric-translation operation In order for the positive rush current as shown in drawing 38 to occur in the photoelectrical transducer 100 and to decrease gradually to it in fact, after the rush current flows, photo-electric-translation operation is begun.
[0227] Next, TFT1400 will be in an OFF state by the low voltage (henceforth low level) pulse of Pd, and G electrode becomes open in direct current. However, potential is kept actual by the capacity of a capacitor 1200, and equivalence-the capacity component and stray capacity of the photoelectrical transducer 100. As for the potential of G electrode to an outflow G electrode, the current which corresponds if the lightwave signal of the photoelectrical transducer 100 is carrying out incidence here goes up.
[0228] That is, the incidence information on light is accumulated as a charge at the capacity which G electrode has. Although fixed TFT1300 for a transfer after the storage time is turned on from an OFF state by the high-level pulse of Pb and the accumulated charge flows to a capacitor 1124, this charge is a value proportional to the integration value of the current which flowed out of the photoelectrical transducer 100 in photo-electric-translation operation, that is, is detected by the detecting element through an operational amplifier 1126 as a total amount of the incidence of light. Moreover, as for the potential of a capacitor 1124, before this transfer operation, it is desirable to be initialized by GND potential by the high-level pulse of Pa of TFT1125.
[0229] And if TFT1300 for a transfer is turned off, TFT1700 for refreshment will be in an ON state by the high-level pulse of Pc again, and a series of operation will be repeated below. In addition, the signal-detection section may include the detection means in the dotted line in drawing 33, TFT1300, and a means to impress the high-level pulse Pb, including a means by which a refreshment means impresses a capacitor 1200 and the high-level pulse Pc in this example, and a power supply 114.
[0230] It is information separator of drawing 38 by giving an electropositive potential to G electrode of an optoelectric transducer through a capacitor 1200 in refreshment operation, and making the electropositive potential into potential smaller than predetermined potential in this example. The positive rush current at the time of accumulation of the signal charge which is not as [show / by the solid line /

set and] is prevented. (If larger than still more nearly predetermined potential, it will become like a dashed line.)
Although it is possible to lengthen time of the initialization pulse of Pd as a method of reducing the positive rush current, by there being a limitation also in the time and lengthening time, the signal reading time of the whole equipment becomes long, and will cause, low-speed-izing, i.e., a performance down, of equipment.
[0231] Then, when from falling of the pulse of Pc to falling of G electrode potential initialization pulse of Pd is operated in about 100micro second by a capacitor's performing refreshment operation and performing a suitable timing setting in this invention, it is V0 as shown in drawing 38. The rush current which are accumulated by carrying out becomes zero mostly. Therefore, the charge which begins to be accumulated from falling of the pulse of Pd becomes able [all] to acquire the information that an SN ratio is high, by becoming a charge by the signal light which carried out incidence into the photoelectrical transducer 100, and reading the signal level mostly. Moreover, the potential V0 (refresh) of G electrode when impressing the high-level pulse (Vres) of Pc is calculated. It is CX about the capacity of C0 and a capacitor 1200 in the sum of the equivalence capacity component of the stray capacity connected to G electrode, and the photoelectrical transducer 100. When it carries out, V0 (refresh) is expressed with the following formula.
[0232]
Capacitor CX which 0(refresh)-=[V] {CX-/(C-0-+-CX)}-x-Vres-twists, and is made V0 (refresh) can be freely changed with a size, and the flexibility when actually designing also increases.
[0233] Although a signal charge can be accumulated where the positive rush current is set to about 0 by giving an electropositive potential to G electrode of an optoelectric transducer through a capacitor 1200 so that clearly from having stated above, the value of the rush current positive by adjusting the potential further given to G electrode of an optoelectric transducer through a capacitor 1200 can be made small, and the damping time can be shortened.
[0234] Since the potential of D electrode of the optoelectric transducer in refreshment operation and G electrode was explained in detail using drawing 24 or drawing 27 into the example 9, it omits about explanation here.
[0235] In this example, the property excellent in driving on condition that the following has been acquired.
[0236] Potential VD of the power supply 114 to which the potential VrG of the power supply 1115 which gives the electropositive potential of G electrode in refreshment operation of the photoelectrical transducer 100 gives an electropositive potential to D electrode It compares and is made low. Since the flat band voltage (VFB) impressed to G electrode exists in the photoelectrical transducer 100 in order to make the energy band of i layers into a flat if it says in detail, to practice, it drives in the state of VrG<VD-VFB.
[0237] Since drawing 29 and drawing 30 have explained concrete operation in detail in the example 10, explanation here is omitted.
[0238] In this example, spending long time of i layers of electrons existing in the interface defect of 4 and an insulating layer 70 on electronic receipts and payments, since there is almost nothing is lost, and it becomes possible to cut down greatly the rush current which serves as a noise component as a result.
[0239] The sum of the equivalence capacity component of stray capacity and photoelectrical transducer 100 ** by which the capacity of a capacitor 1200 is connected to CX and G electrode C0, And high-level pulse Vres of Pc If it carries out, in G electrode potential at the time of refreshment, VrG will serve as VrG=V0(refresh) = {CX/(C0+CX)} xVres. {CX/(C0+CX)} xVres If it drives on the conditions that a value is smaller than VD-VFB, the above-mentioned effect can be acquired. V0 obtained on condition that VrG=V0 (refresh) >= (VD-VFB) shown by drawing 38 The rush current accumulated further can be reduced.
[0240] The 2nd electrode layer is not made into the transparent electrode here. Moreover, the pouring blocking layer between i layers of the photoelectrical transducer 100 and the 2nd electrode layer is n type, and the carrier with which pouring is prevented is a hole. If the charge of one carrier with which

pouring is prevented for the reason is set to q, it will be set to $q > 0$ in this case.

[0241] Moreover, in explanation of this example, you may constitute a hole and an electron conversely. For example, ****** [the number of pouring blocking layers / P]. In this case, the direction which voltage and electric field impress in this example is made reverse, and if other portions are constituted similarly, the same result of operation as the above-mentioned example will be obtained.

TECHNICAL FIELD

[Industrial Application] this invention relates to the system which has the possible single dimension of performing actual size reading of facsimile, a digital copier, or X-ray image pck-up equipment or a 2-dimensional photoelectrical inverter, its drive method, and it with respect to the system which has a photoelectrical inverter, its drive method, and it.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] As explained in full detail above, according to this invention, an SN ratio is high, and the system which has the photoelectrical inverter whose property is stable, its drive method, and it can be offered.
[0344] Moreover, according to this invention, the yield is high and can offer a photoelectrical inverter with easy production.
[0345] In addition, according to this invention, the system which forming in the same process as TFT is possible, is not made to produce complication of a production process, and has a photoelectrical inverter producible by the low cost, its drive method, and it can be offered.
[0346] According to this invention, a pouring blocking layer can detect the amount of incidence of light only by one place, optimization of a process is easy for the photoelectrical transducer in a photoelectrical inverter (optoelectric transducer), and it can aim at improvement in the yield, and reduction of a manufacturing cost is possible for it, and it can offer the photoelectrical inverter of a low cost with a high SN ratio. Furthermore, since neither the tunnel effect nor the Schottky barrier is used in the first electrode layer / insulating layer / photo-electric-translation semiconductor layer, an electrode material can be chosen freely and control of insulating layer thickness or others also has flexibility high [an electrode material]. moreover, the film composition with an optoelectric transducer and TFT important [that it can form simultaneously as a film with switching devices, such as a thin film field-effect transistor (TFT), and capacitative element common since matching is good and is the same film composition which are formed simultaneously] -- the inside of the same vacuum -- simultaneous -- formation -- possible -- further -- a photoelectrical inverter -- a raise in SN -- it can low-cost-ize
[0347] Moreover, optical information is stored in the optoelectric transducer itself as a carrier, and since it has simultaneously the property to pass current in real time, the photoelectrical inverter which has a complex function with easy composition can be offered. Moreover, the highly efficient photoelectrical inverter which can output the integration value of the optical information which the capacitor also contains the insulating layer in the interlayer, could form in the good property, and was acquired by the optoelectric transducer with easy composition can be offered.
[0348] Moreover, in this invention, it becomes it is possible and possible in refreshment operation of an optoelectric transducer to generate the rush current also of carrying out through the capacity of a capacitor etc. at the moment of lowering applied voltage. Compared with the case where it refreshes using TFT as a result, the rush current accumulated is cut down sharply, and the photoelectrical inverter of a low cost with a more high SN ratio can be offered.
[0349] Moreover, when the charge q of the carrier with which pouring is prevented in refreshment operation of an optoelectric transducer when the semiconductor pouring blocking layer of an optoelectric transducer is n type is positive, {(VrG-q)< (VD and q-VFB-q)} which makes potential of D electrode higher than the potential of G electrode -- by things It becomes possible to carry out by not carrying out receipts and payments of the electron to the interface defect of an insulating layer and a photo-electric-translation semiconductor layer. conversely, {(VrG-q)< (VD and q-VFB-q)} which makes potential of D electrode lower than the potential of G electrode when the charge q of the carrier

with which it is prevented, the case, i.e., pouring, of the semiconductor pouring blocking-layer p type of an optoelectric transducer, is negative -- things -- Since it becomes possible to carry out by not carrying out receipts and payments of the electron to the interface defect of an insulating layer and a photo-electric-translation semiconductor layer. The rush current can be reduced and the photoelectrical inverter of a low cost with a still higher SN ratio can be offered.
[0350] Moreover, the thing which the laminated structure of the capacitative element for signal-charge accumulation is made the same as that of an optoelectric transducer, and is further accumulated to the electrode by the side of the insulating layer of this capacitative element for signal-charge accumulation, It becomes possible to always use the capacitative element for signal-charge accumulation in the state of AKYUMURESHON, and seemingly, through the capacitative element for signal-charge accumulation, the leakage current which a signal charge leaks and produces can be reduced, and the photoelectrical inverter of a low cost with a high SN ratio can be offered.
[0351] Moreover, since reading operation can be performed at high speed since it is possible to divide two or more optoelectric transducers into a block, and to drive simultaneously the signal transfer operation and refreshment operation in another block by the same drive wire, and equipment can be miniaturized further, it becomes possible to offer the high yield and a low cost photoelectrical inverter.
[0352] Moreover, the facsimile and X-ray roentgen equipment of a large area, high efficiency, and a quantity property can be offered more by the low cost by using the photoelectrical inverter which has an outstanding property which was described above.
[0353] In addition, this invention is not limited to the composition or the above-mentioned example which gave [above-mentioned] explanation, and it cannot be suitably overemphasized in the range of the main point of this invention that deformation combination is possible.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, an SN ratio is high at the above-mentioned conventional photosensor, and it is difficult to produce the photoelectrical inverter of a low cost. The reason is explained below.
[0007] The first reason has both the PIN type of drawing 4 (a), and the Schottky type of drawing 4 (b) in the place which needs two pouring blocking layers.
[0008] In the PIN type of drawing 4 (a), n layers of properties which prevent that a hole pours [which is a pouring blocking layer] i layers into 4 are required for it at the same time 5 leads an electron to a transparent electrode 6. If one of properties are missed, a photocurrent will fall, or current (it is described as the dark current below) in case light does not carry out incidence will occur and increase, and causes [of an SN ratio] a fall. Even if this dark current carries out processing which is called shot noise and which swings, contains the so-called quantum noise and deducts the dark current by the detecting element 12 even if at the same time itself is considered to be a noise, it cannot make the quantum noise accompanying the dark current small.
[0009] Usually, in order to raise this property, it is necessary to attain i layers of optimization of 4, the conditions of membrane formation of n layer 5, and the conditions of annealing after creation. However, although an electron and a hole are reverse also about p layer 3 which is another pouring blocking layer, an equivalent property is required, and each conditions need to be optimized similarly. Usually, the conditions of optimization of n layers of former and optimization of p layers of latters are not the same, and it is difficult to satisfy both conditions simultaneously.
[0010] That is, that two pouring blocking layers are required in the same photosensor makes formation of the photosensor of a high SN ratio difficult.
[0011] This is the same also in the Schottky type of drawing 4 (b). Moreover, although the Schottky barrier layer is used for one of the two's pouring blocking layer in the Schottky type of drawing 4 (b), it is still more difficult for this to use i layers of differences of the work function of 4 with the lower electrode 2, and to limit the material of the lower electrode 2, or for the influence of the localized level of an interface to influence a property greatly, and to satisfy conditions.
[0012] Furthermore, although forming i layers of the oxide films of the thin silicon metallurgy group around 100A and nitrides between 4 with the lower electrode 2 is also reported in order to raise the property of a Schottky barrier layer Since this uses the tunnel effect, leads a hole to the lower electrode 2, and raises the electronic effect which prevents i layers of pourings to 4 and the difference of a work function is used too, the material of the lower electrode 2 needs to be limited. In addition, in order to use the reverse property of prevention of electronic pouring, and movement of the hole by the tunnel effect, it is required that an oxide film and a nitride should be made very thin 100A order. And as for the thickness and membraneous control, productivity falls difficultly.
[0013] Moreover, that two pouring blocking layers are required becomes the factor which it not only reduces productivity, but raises cost. This is because the desired property as a photosensor is not acquired when at least one defect arises [a pouring blocking layer] with dust etc. among property overlay important point hatchet two places.

[0014] The second reason is explained using drawing 2 . Drawing 2 shows the lamination of the field effect transistor (TFT) formed by the semiconductor film of a thin film. TFT may be used as a part of control section, when forming a photoelectrical inverter. The jack per line has shown the same thing as drawing 4 in drawing. In drawing 2 , 7 is a gate insulator layer and 60 is an up electrode. Order is explained for the forming method later on. On an insulating substrate 1, the lower electrode 2 which works as a gate electrode (G), and the up 7 or i layer electrode 60 which works as 5, the source, and drain electrodes (S, D) 4 or n layers of gate insulator layers are formed one by one, the up electrode 60 is **********ed, the source and a drain electrode are formed, n layers ********** 5 after that, and the channel section is constituted. i layers of properties of TFT are as sensitive to the state of the interface of 4 as the gate insulator layer 7, and in order to usually prevent the contamination, they are deposited on continuation within the same vacuum.

[0015] When forming the conventional photosensor on the same substrate as this TFT, this lamination poses a problem and causes a cost rise and the fall of a property. This reason is that both lamination differs to being the composition of [composition / of the conventional photosensor / which was shown in drawing 4 / type / PIN / of drawing 4 (a)] an electrode / i layer/n layer / electrode in an electrode / p layer / i layer/n layer / electrode, and the Schottky type of drawing 4 (b) with composition called in TFT an electrode / insulator layer / i layer/n layer / electrode. This shows that a photosensor and TFT cannot be simultaneously formed in the same process, and it causes the fall of the yield by complication of the process by which a FOTORISO process etc. is repeated, and a cost rise in order to form a layer required for a required place. Moreover, for communaliz(ing), i layers of interfaces of 4 are polluted by communalizing an i layer [/n] layer by etching of a gate insulator layer with the gate insulator layer 7 of the pouring blocking layer which are the gate insulating layer 7 and an important layer of a photosensor which p layers of etching processes of 3 were needed, and was described previously where TFT is important in the ability of 4 not forming membranes within the same vacuum with 3, and it becomes degradation of a property, and the cause of a fall of

[0016] Moreover, although the order of film composition of the lower electrode 2 and the thing in which i layers of oxide films and nitrides were formed between 4 is the same in order to improve the Schottky type characteristic of drawing 4 (b) mentioned above, as stated previously, an oxide film and a nitride need to be before and after 100A, and it is difficult [it] to use with a gate insulator layer in common. The result in which we experimented on drawing 3 about the yield of a gate insulator layer and TFT is shown. As for the yield, gate insulation thickness fell rapidly by 1000A or less, by 500A, the yield has not been checked about 30% in 800A, and even operation of TFT has not checked [250A] the yield 0%. It is clearly difficult to common-use-ize the oxide film of the photosensor using the tunnel effect, a nitride, and the gate insulator layer of TFT which must insulate an electron and a hole, and data show this.

[0017] Furthermore, although not illustrated, it is difficult for leak to make a few good property thing from the same composition as the conventional photosensor for the capacitative element (for it to be described as a capacitor below) which is an element which is needed for acquiring the integration value of a charge or current. Since the conventional photosensor uses only the semiconductor layer for inter-electrode to the layer from which accumulating a charge to inter-electrode [two] surely prevents movement of an electron and a hole to a purpose hatchet inter-electrode interlayer being required for a capacitor, the interlayer of a good property with little leak is thermally obtained because it is difficult.

[0018] Thus, it may become a problem serious since a process becomes mostly and complicated when the whole system which TFT and a capacitor a capacitor, and that matching is not good arrange a majority of two or more photosensors to a single dimension or two dimensions, and detects this lightwave signal one by one is constituted, when the yield is very bad and makes various functions highly efficiently equipment from a low cost in process or in property. [which are an element important when a photoelectrical inverter is constituted]

[0019] The purpose of the [purpose of invention] this invention has a high SN ratio, and it aims at offering the system which has the photoelectrical inverter whose property is stable, its drive method, and it.

[0020] Moreover, the yield of this invention is high and production aims at offering the system which has an easy photoelectrical inverter and easy it.
[0021] In addition, this invention can be formed in the same process as TFT, and it aims at offering the system which has a photoelectrical inverter producible by the low cost, its drive method, and it, without producing complication of a production process.

[Translation done.]

DESCRIPTION OF DRAWINGS

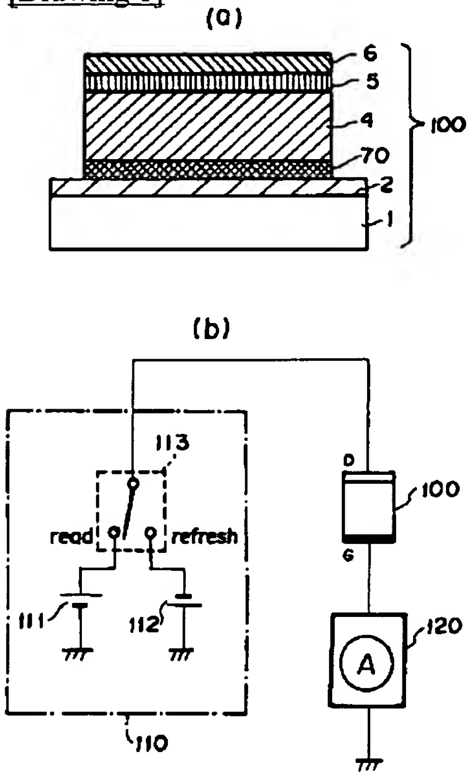
[Brief Description of the Drawings]
[Drawing 1] The typical cross section (a) and rough circuit diagram (b) for explaining the example of composition of the photoelectrical transducer of this invention.
[Drawing 2] The typical cross section for explaining the example of composition of TFT.
[Drawing 3] Drawing for explaining an example of the thickness of the gate insulator layer of TFT, and the relation of the yield.
[Drawing 4] The typical cross section for explaining an example of the composition of a photosensor.
[Drawing 5] The energy-band view for explaining the energy state of a photoelectrical transducer.
[Drawing 6] The timing chart for explaining an example of operation of the photoelectrical inverter of this invention.
[Drawing 7] The rough circuit diagram for explaining the example of composition of a detecting element.
[Drawing 8] The rough circuit diagram for explaining the photoelectrical inverter of this invention.
[Drawing 9] The typical cross section for explaining an example of the photoelectrical transducer of this invention.
[Drawing 10] The typical cross section (a) and rough circuit diagram (b) for explaining the example of composition of the photoelectrical inverter containing the photoelectrical transducer of this invention.
[Drawing 11] The typical cross section (a) and rough circuit diagram (b) for explaining the example of composition of the photoelectrical inverter containing the photoelectrical transducer of this invention.
[Drawing 12] The rough circuit diagram for explaining the photoelectrical inverter of this invention.
[Drawing 13] The typical plan (a) for explaining an example of the photoelectrical inverter of this invention, and a typical cross section (b).
[Drawing 14] The rough circuit diagram for explaining the photoelectrical inverter of this invention.
[Drawing 15] The typical plan (a) for explaining an example of the photoelectrical inverter of this invention, and a typical cross section (b).
[Drawing 16] The rough circuit diagram for explaining the photoelectrical inverter of this invention.
[Drawing 17] The typical plan (a) for explaining an example of the photoelectrical inverter of this invention, and a typical cross section (b).
[Drawing 18] The timing chart for explaining an example of operation of the photoelectrical inverter of this invention.
[Drawing 19] The rough circuit diagram for explaining the photoelectrical inverter of this invention.
[Drawing 20] The typical plan (a) for explaining an example of the photoelectrical inverter of this invention, and a typical cross section (b).
[Drawing 21] The timing chart for explaining an example of operation of the photoelectrical inverter of this invention.
[Drawing 22] The typical arrangement block diagram for explaining the example of mounting of a photoelectrical inverter.
[Drawing 23] The typical arrangement block diagram for explaining the example of mounting of a

photoelectrical inverter.
[Drawing 24] The rough circuit diagram for explaining the photoelectrical inverter of this invention.
[Drawing 25] The timing chart for explaining an example of operation of the photoelectrical inverter of this invention.
[Drawing 26] The energy-band view for explaining the energy state of a photoelectrical transducer.
[Drawing 27] The energy-band view for explaining the energy state of a photoelectrical transducer.
[Drawing 28] The rough circuit diagram for explaining the photoelectrical inverter of this invention.
[Drawing 29] The timing chart for explaining an example of operation of the photoelectrical inverter of this invention.
[Drawing 30] The energy-band view for explaining the energy state of a photoelectrical transducer.
[Drawing 31] The rough circuit diagram for explaining the photoelectrical inverter of this invention.
[Drawing 32] The typical plan for explaining an example of the photoelectrical inverter of this invention.
[Drawing 33] The rough circuit diagram for explaining the photoelectrical inverter of this invention.
[Drawing 34] The timing chart for explaining an example of operation of the photoelectrical inverter of this invention.
[Drawing 35] The rough circuit diagram for explaining the photoelectrical inverter of this invention.
[Drawing 36] The typical plan for explaining an example of the photoelectrical inverter of this invention.
[Drawing 37] The typical cross section for explaining an example of the photoelectrical inverter of this invention.
[Drawing 38] The timing chart for explaining an example of operation of the photoelectrical inverter of this invention.
[Drawing 39] The rough circuit diagram for explaining the photoelectrical inverter of this invention.
[Drawing 40] The timing chart for explaining an example of operation of the photoelectrical inverter of this invention.
[Drawing 41] The rough circuit diagram for explaining the photoelectrical inverter of this invention.
[Drawing 42] The rough circuit diagram for explaining the photoelectrical inverter of this invention.
[Drawing 43] The timing chart for explaining an example of operation of the photoelectrical inverter of this invention.
[Drawing 44] The rough circuit diagram for explaining the photoelectrical inverter of this invention.
[Drawing 45] The typical plan for explaining an example of the photoelectrical inverter of this invention.
[Drawing 46] The typical cross section for explaining an example of the photoelectrical inverter of this invention.
[Drawing 47] The rough circuit diagram for explaining the photoelectrical inverter of this invention.
[Drawing 48] The typical plan for explaining an example of the photoelectrical inverter of this invention.
[Drawing 49] The typical cross section for explaining an example of the photoelectrical inverter of this invention.
[Drawing 50] The rough circuit diagram for explaining the photoelectrical inverter of this invention.
[Drawing 51] The system configuration view for explaining an example of a system which has the photoelectrical inverter of this invention.
[Drawing 52] The typical block diagram (a) explaining an example at the time of applying to the equipment for X-ray detection, a typical cross section (b).
[Drawing 53] The system configuration view for explaining an example of a system which has the photoelectrical inverter of this invention.

[Translation done.]

DRAWINGS

[Drawing 1]



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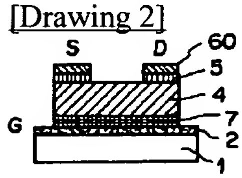

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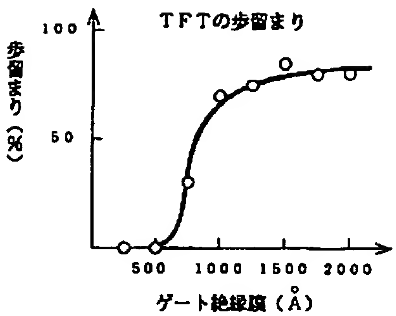

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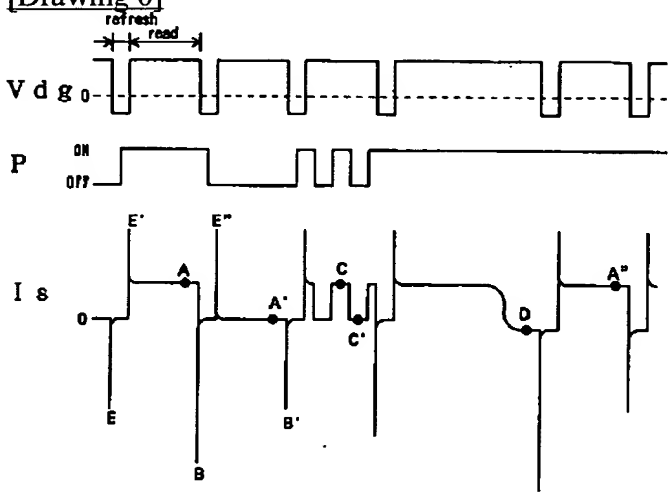

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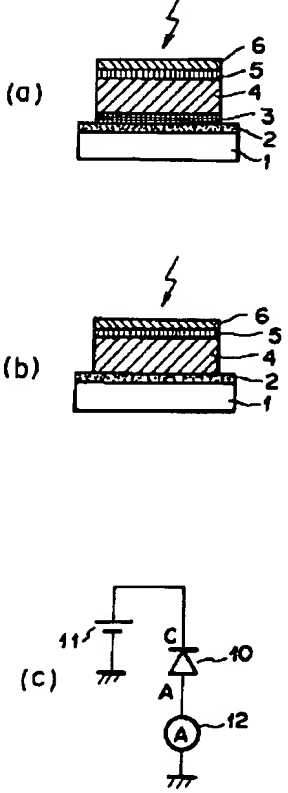

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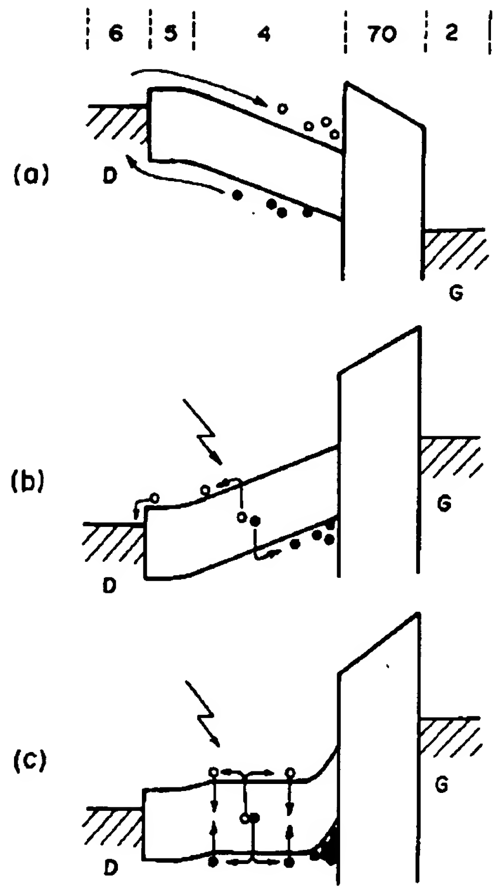

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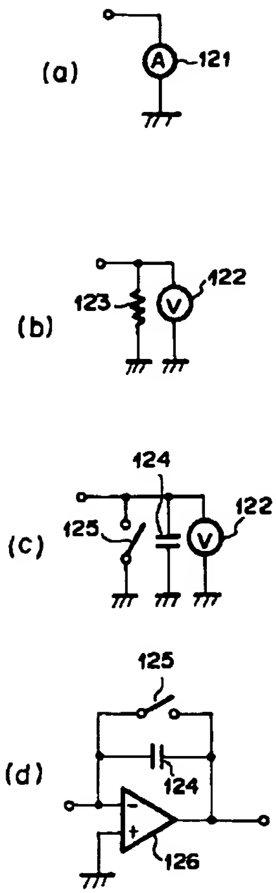

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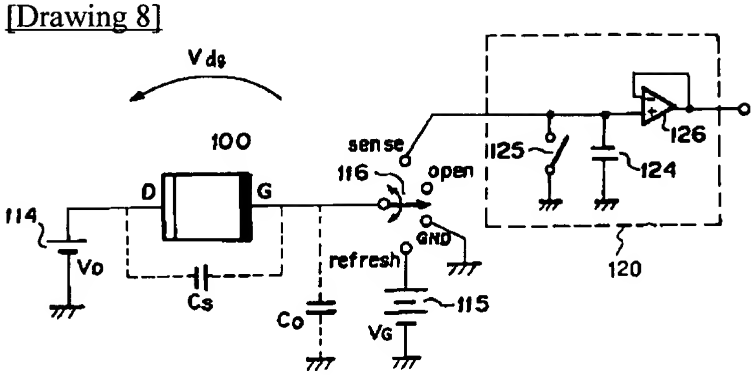

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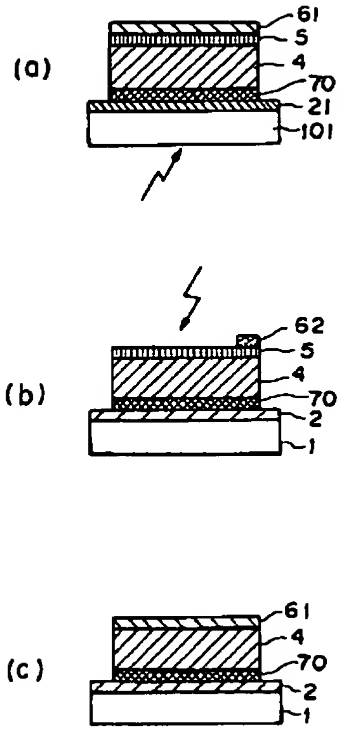

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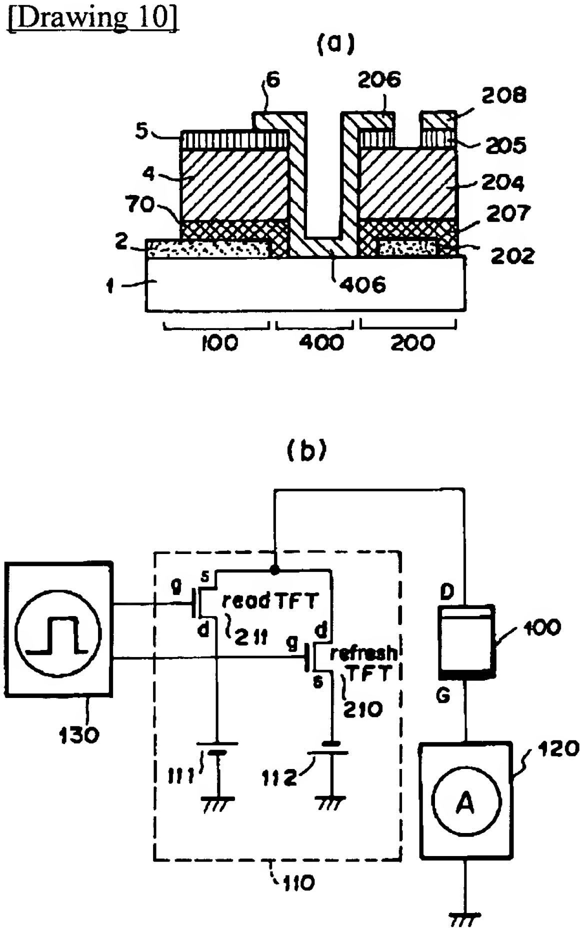

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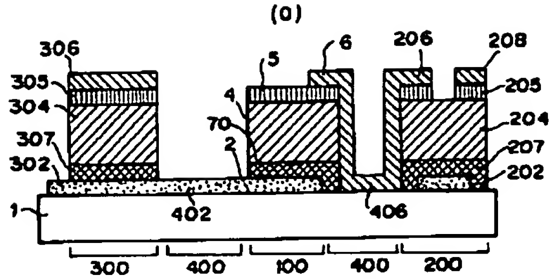
h g cg b eb cg e e

(a)



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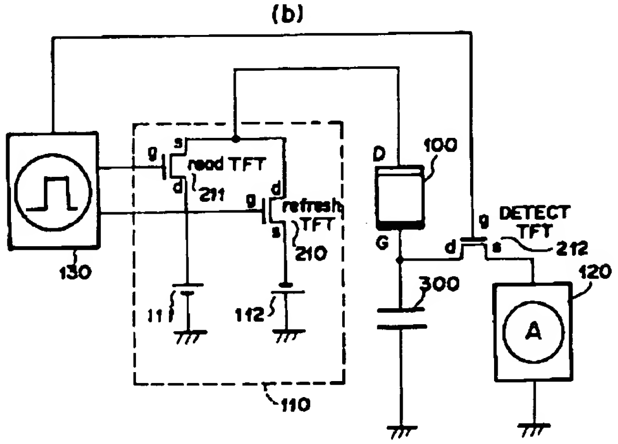

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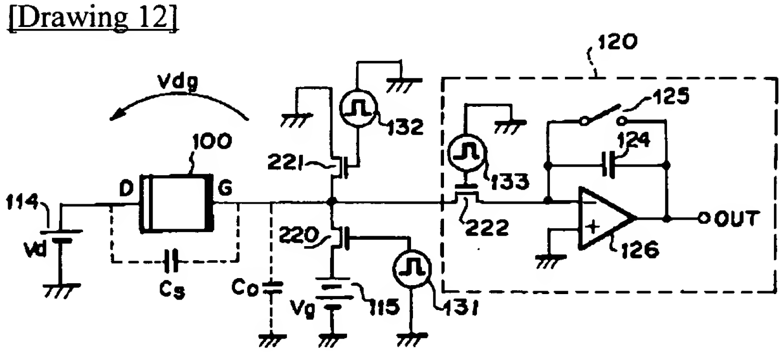

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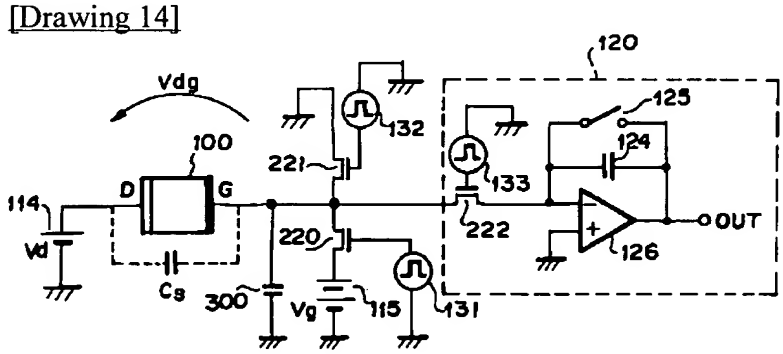

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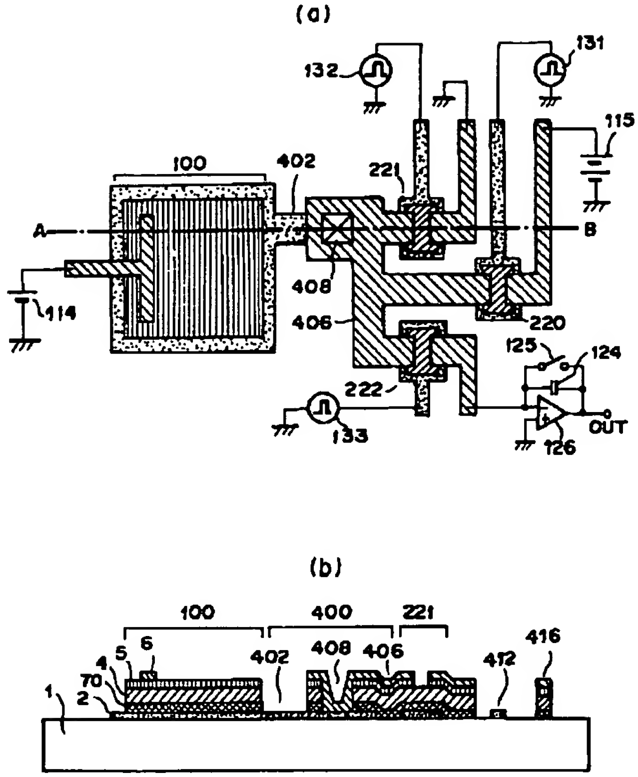

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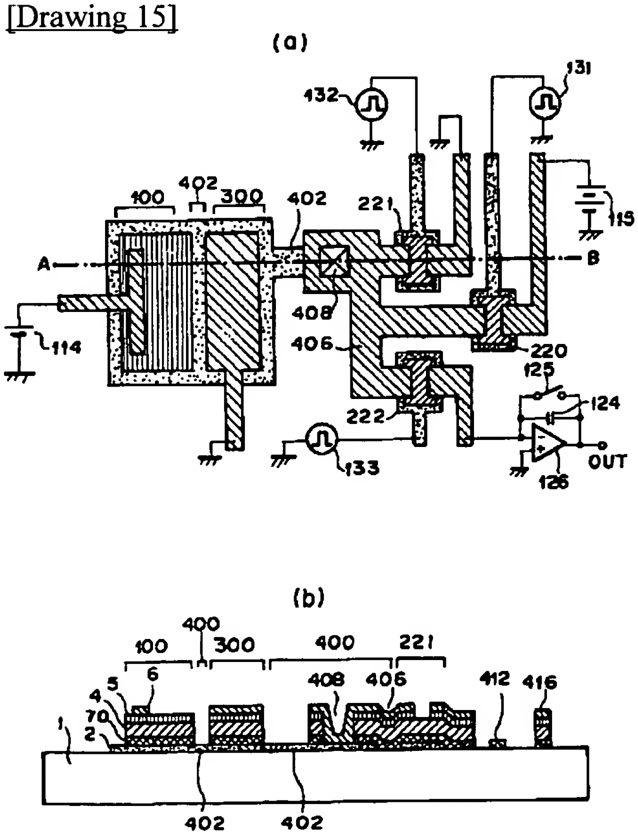

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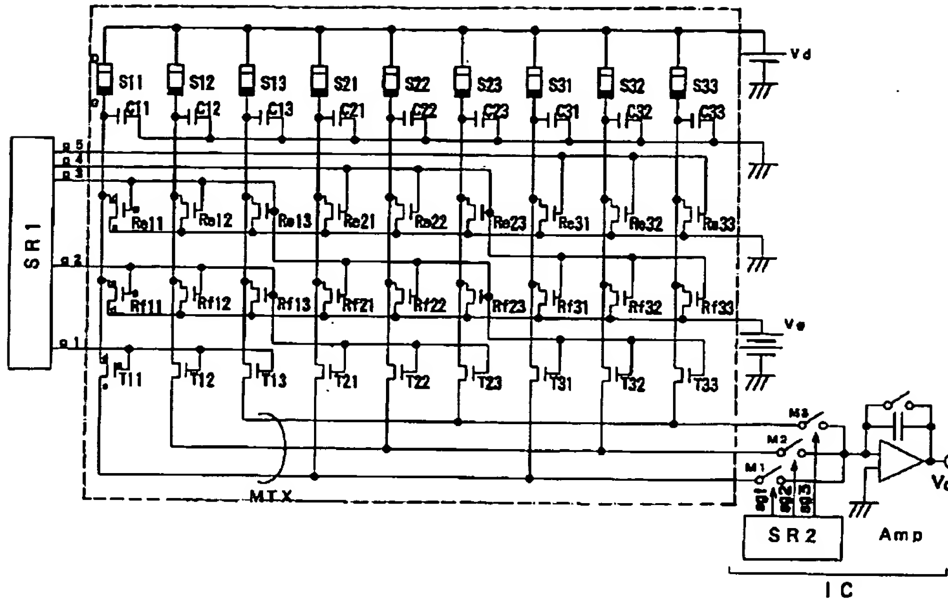

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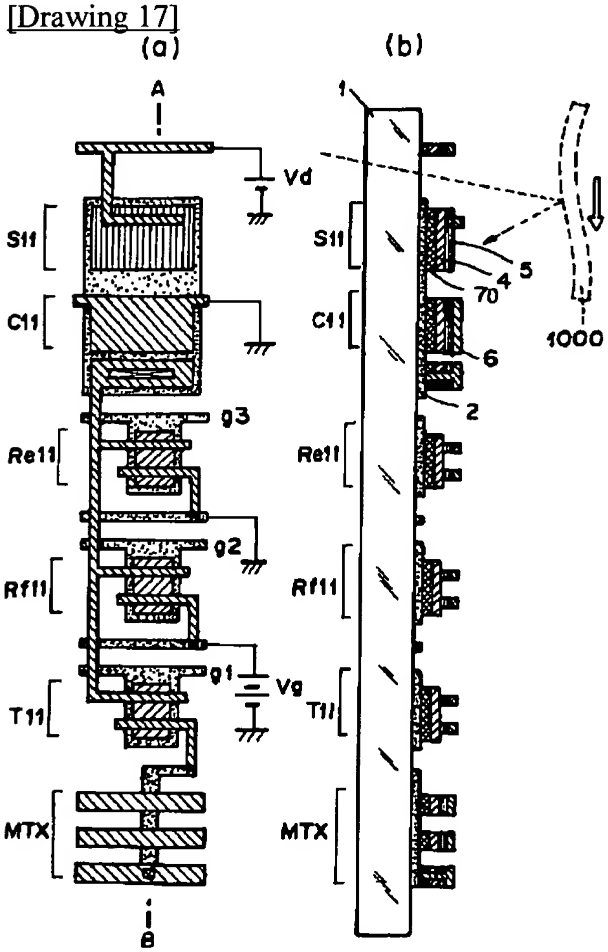

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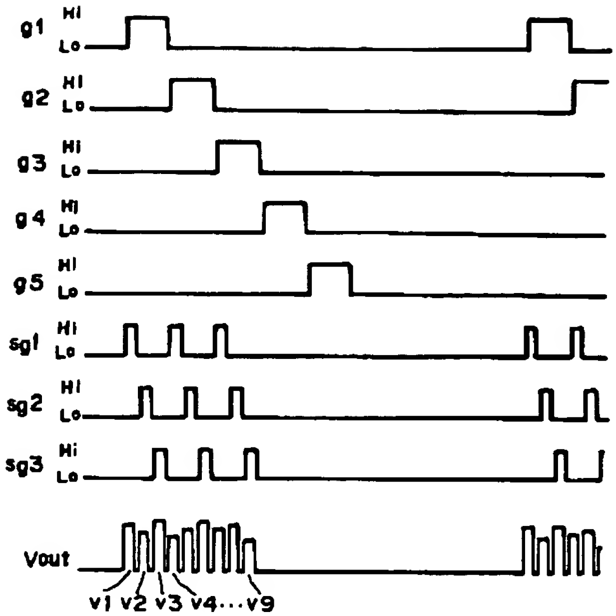

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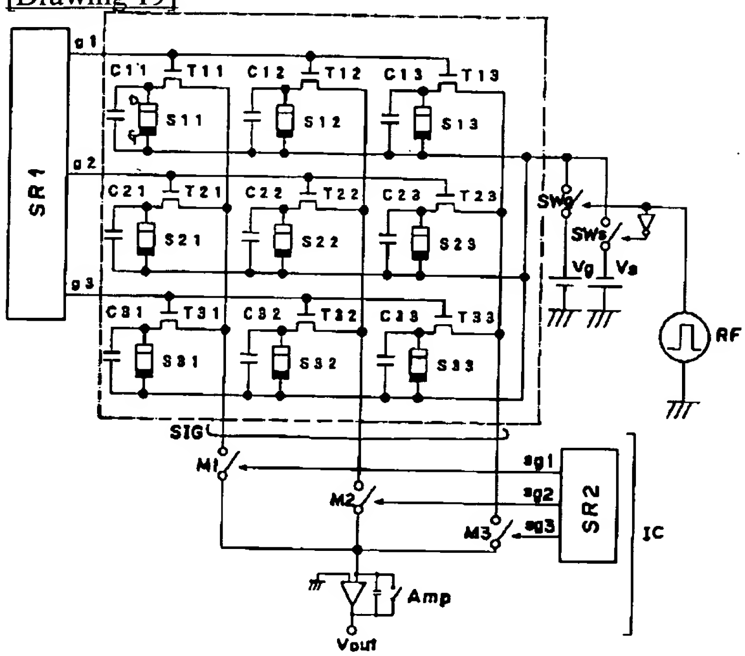

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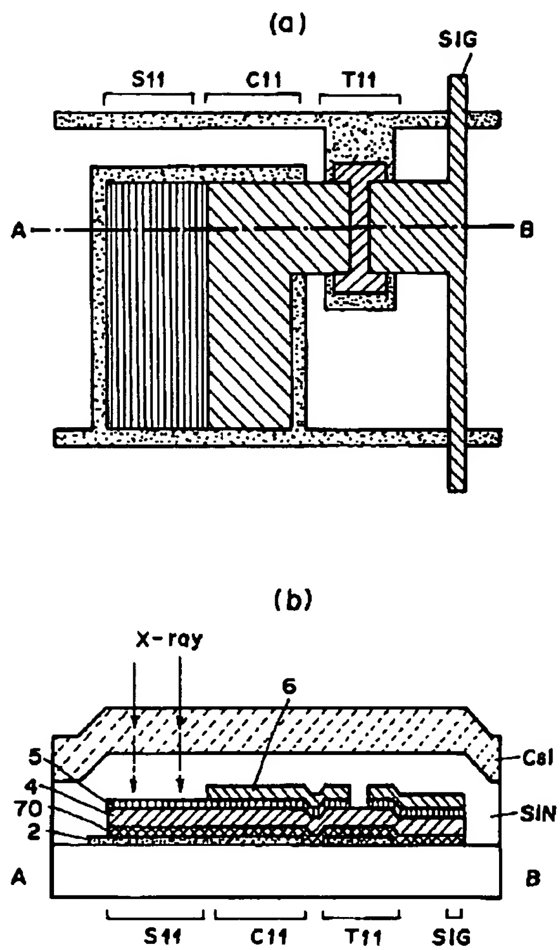

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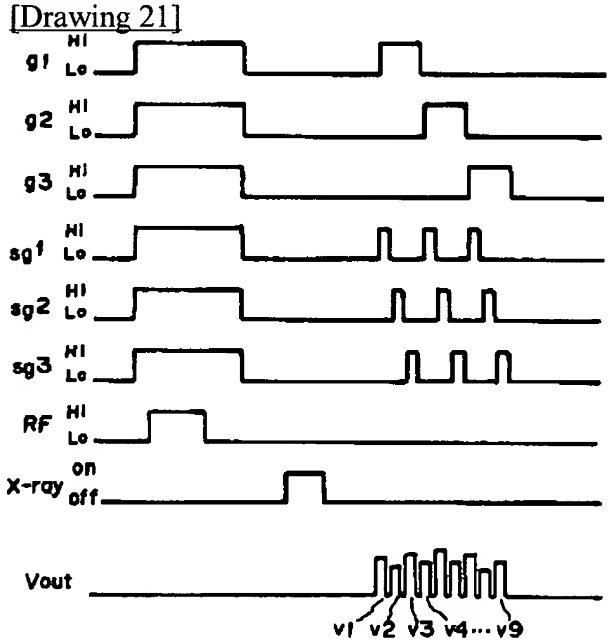

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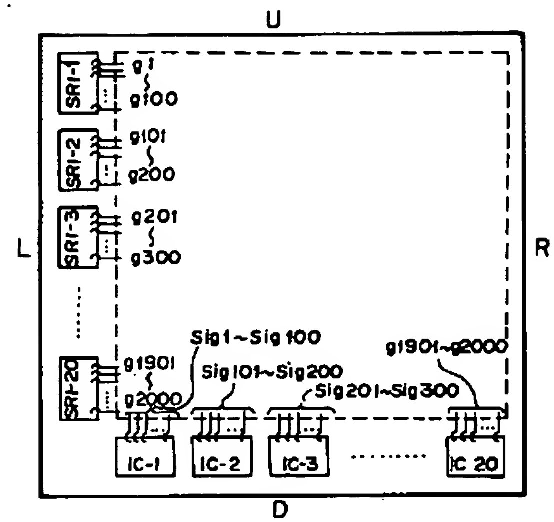

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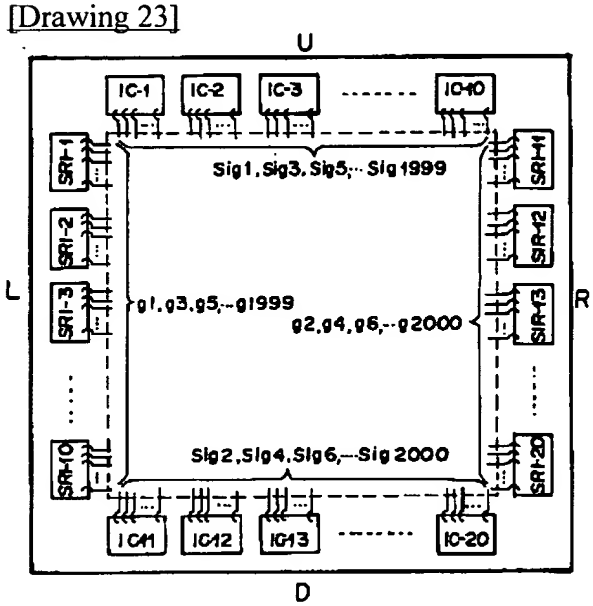

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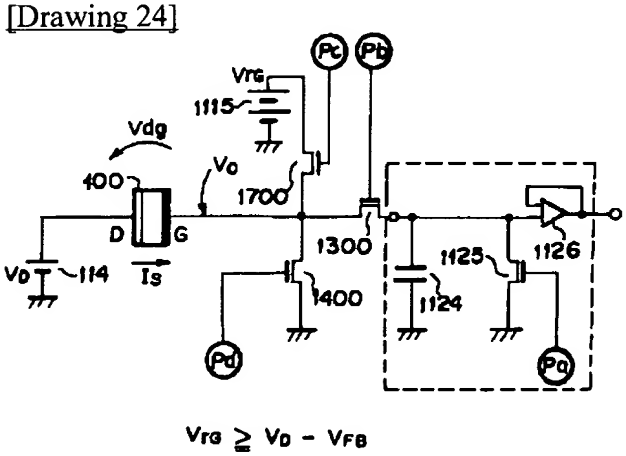

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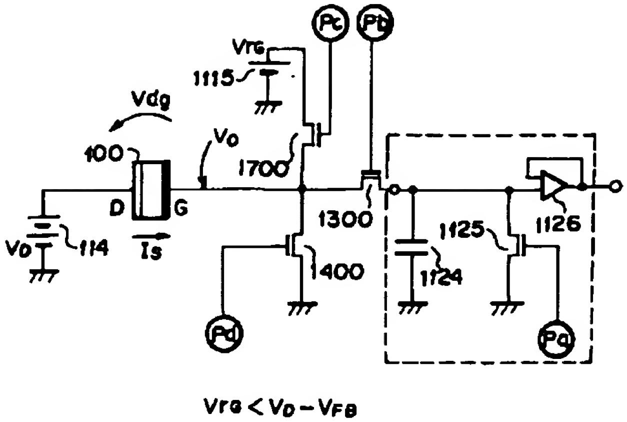

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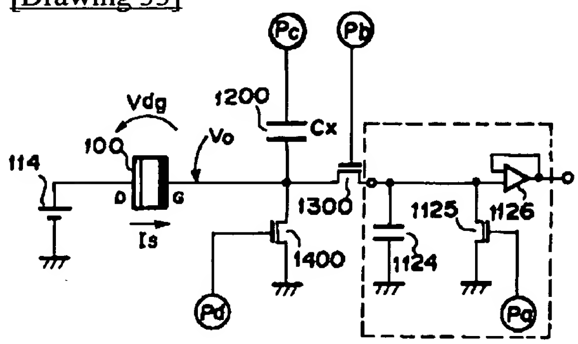

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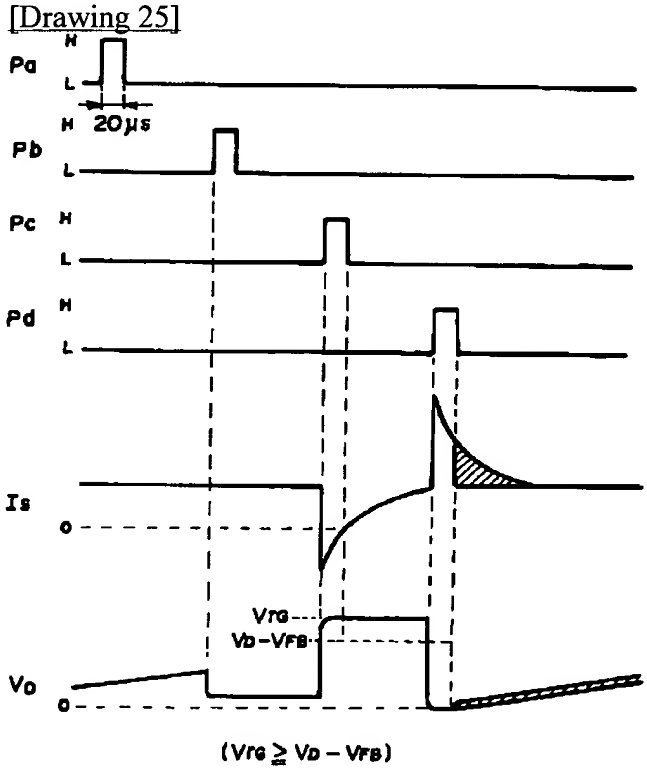

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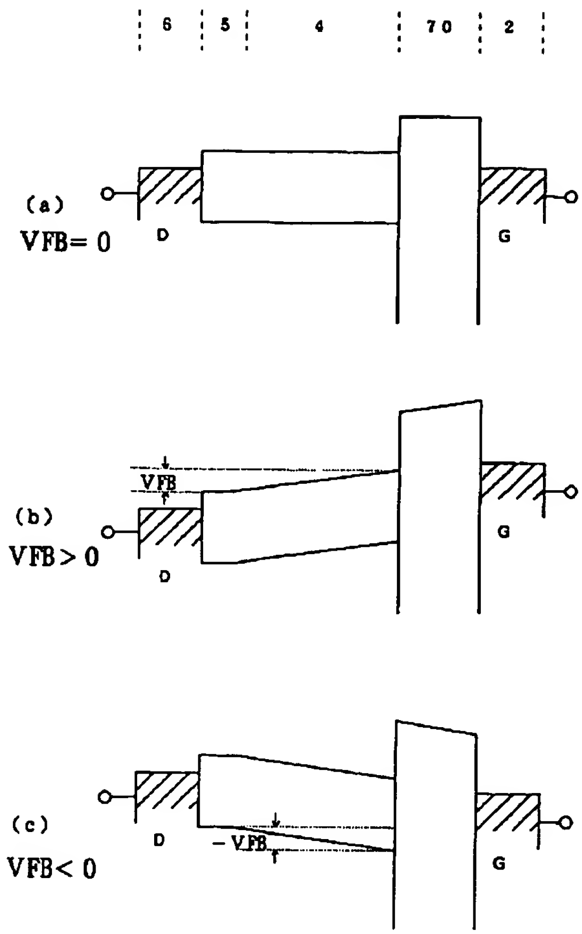

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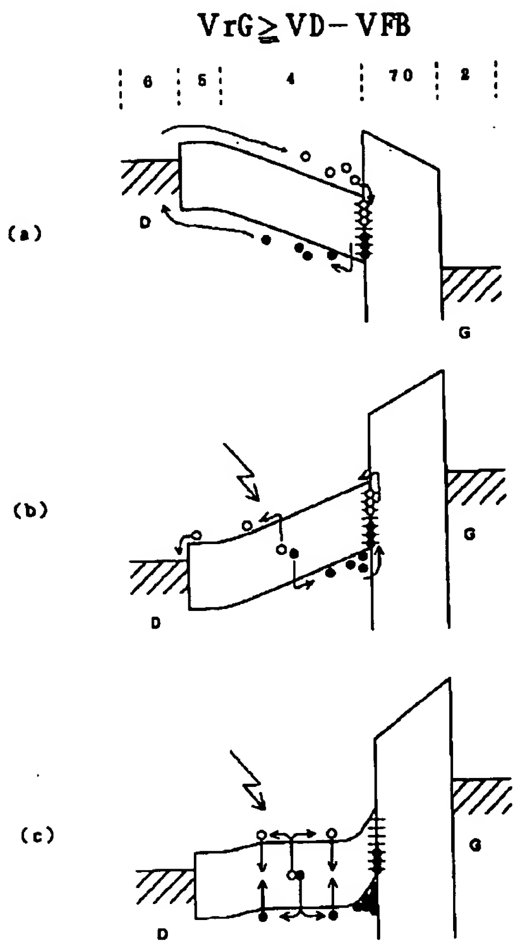

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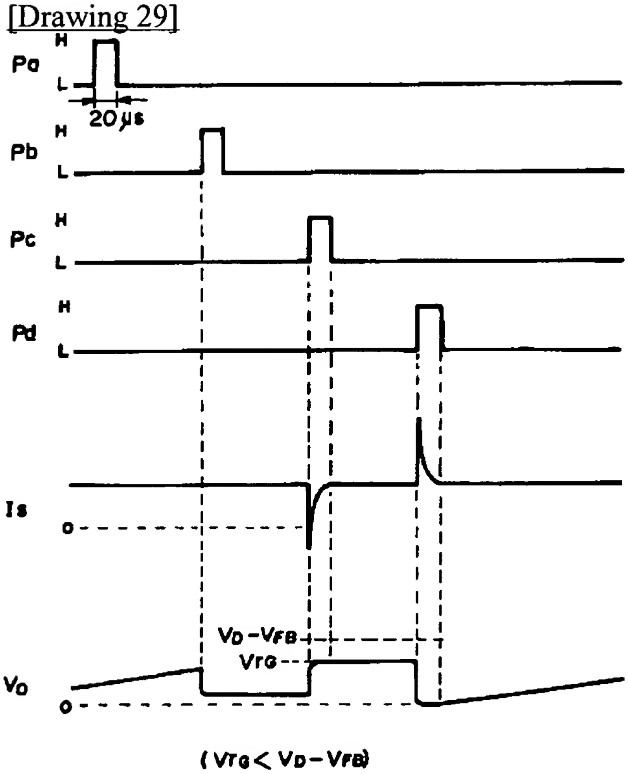
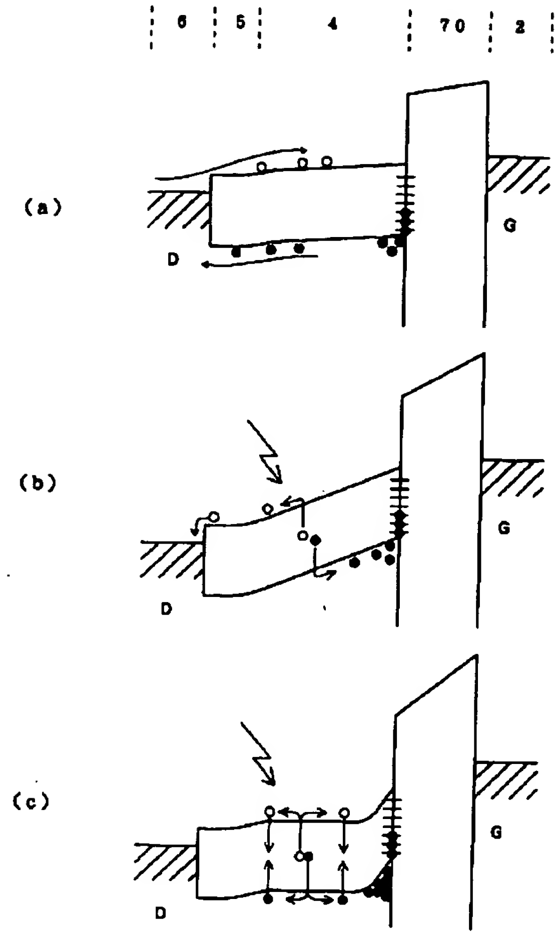


[Drawing 30]

h g cg b eb cg e e

VrG< VD− VFB



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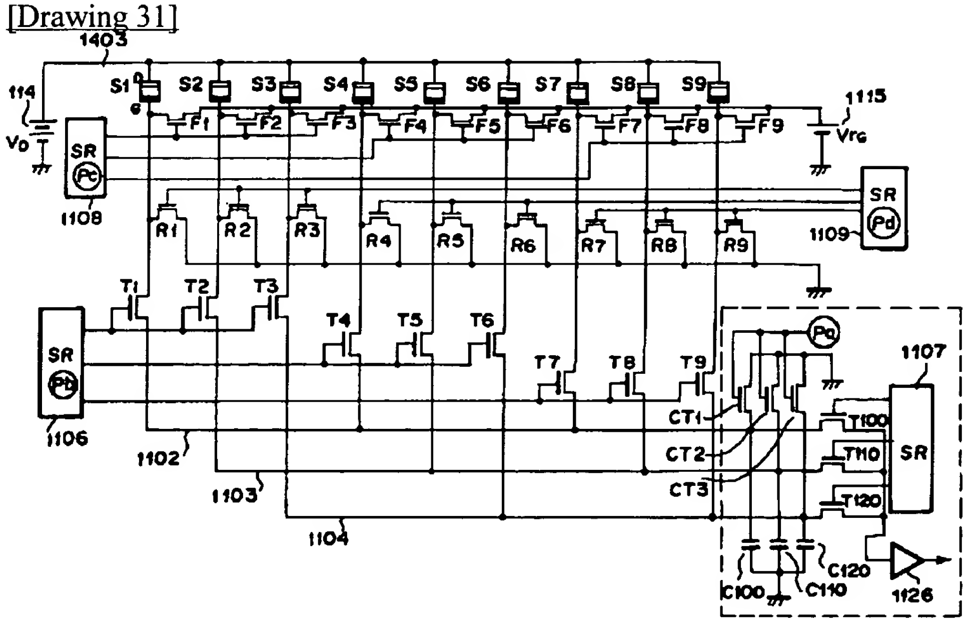

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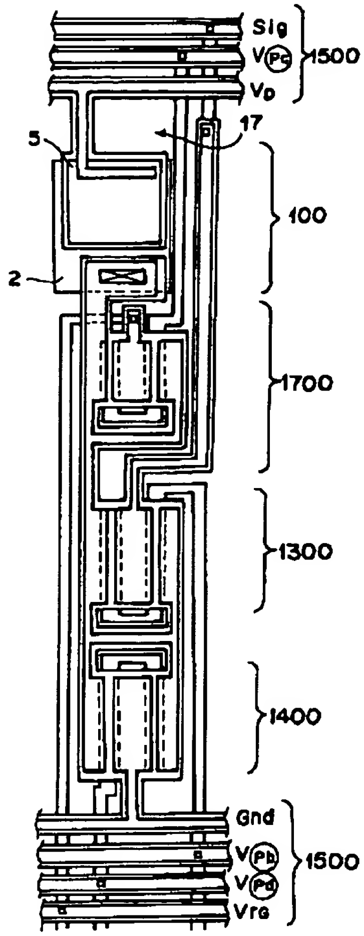

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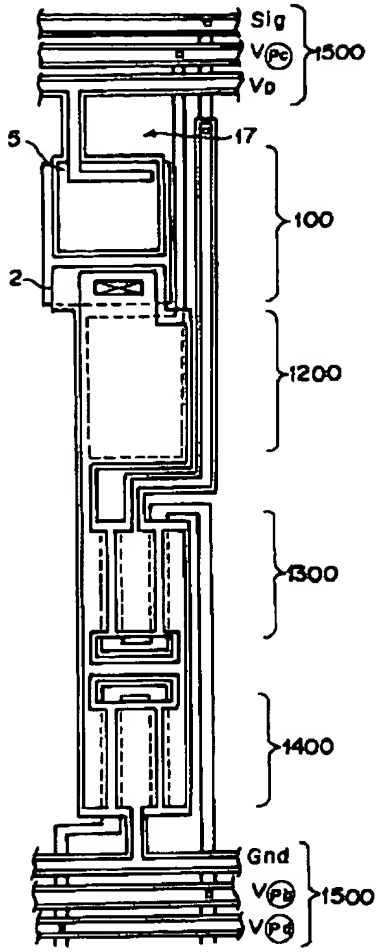

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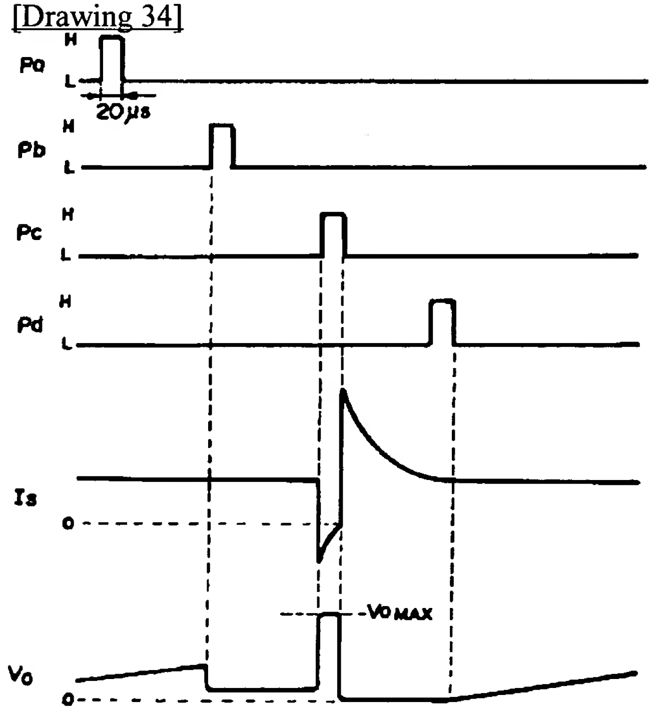

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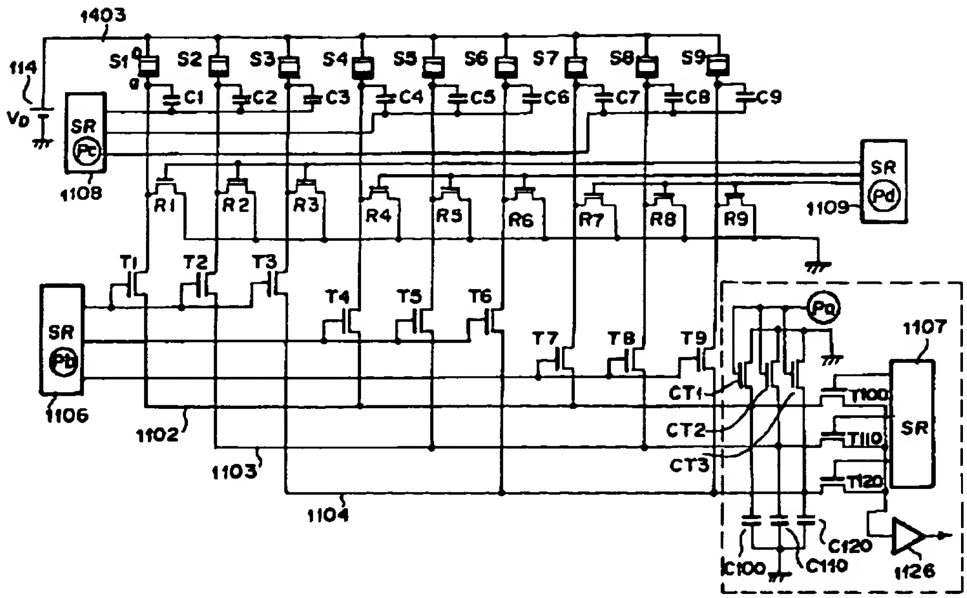

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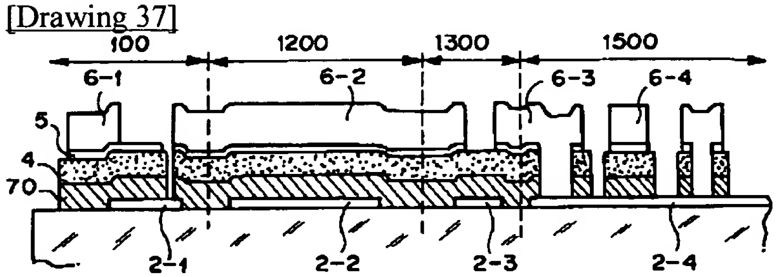

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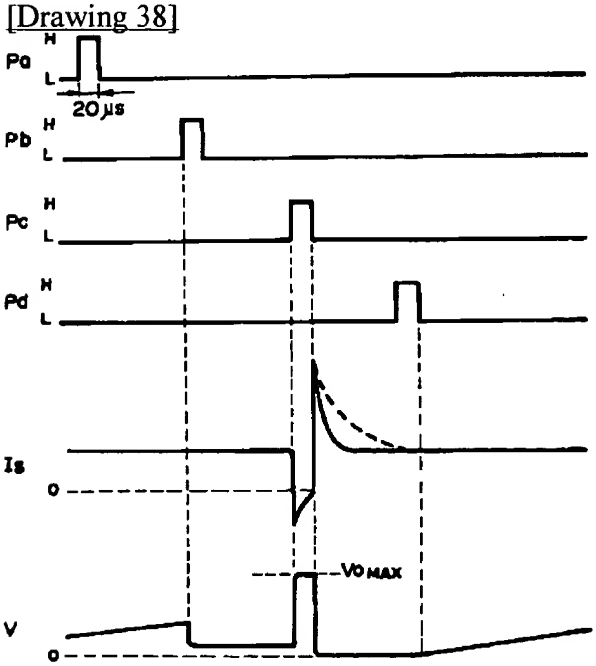

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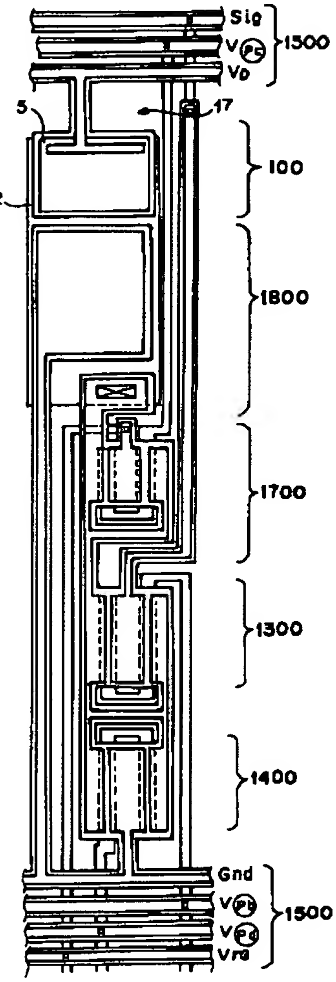

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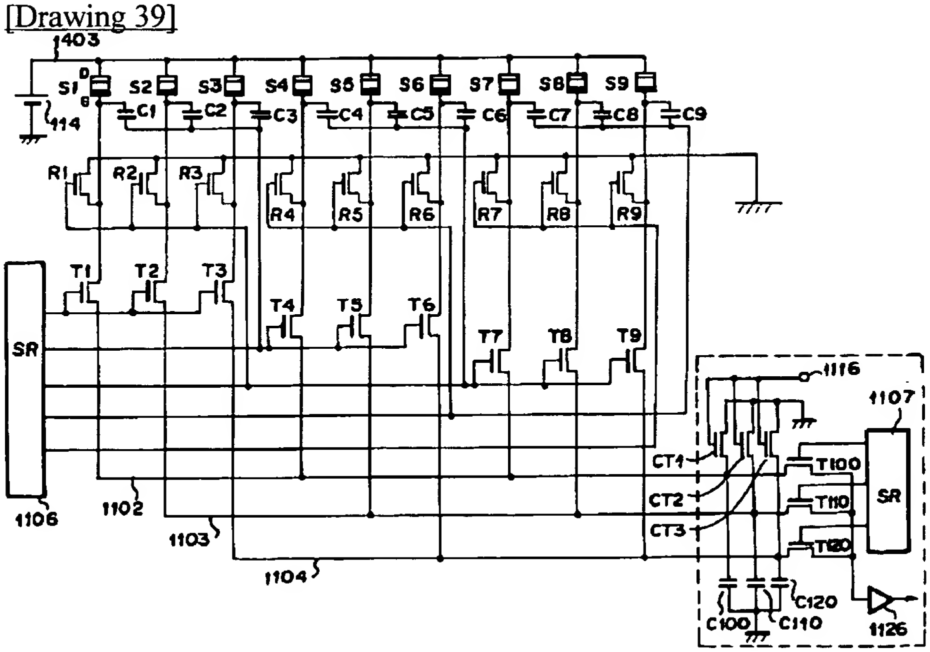

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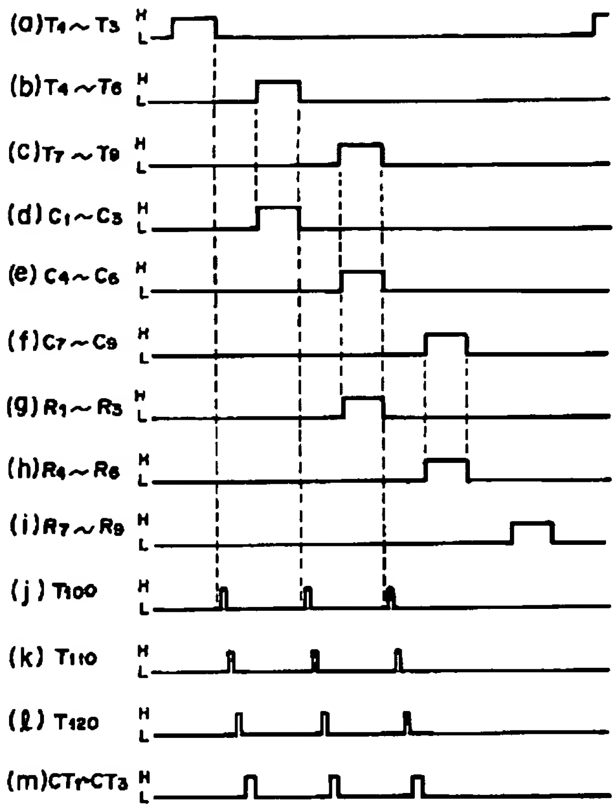

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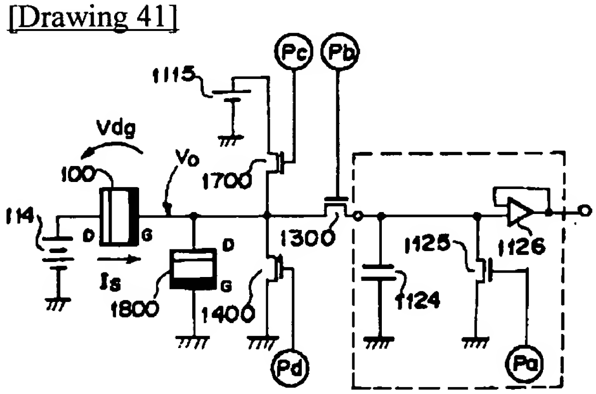

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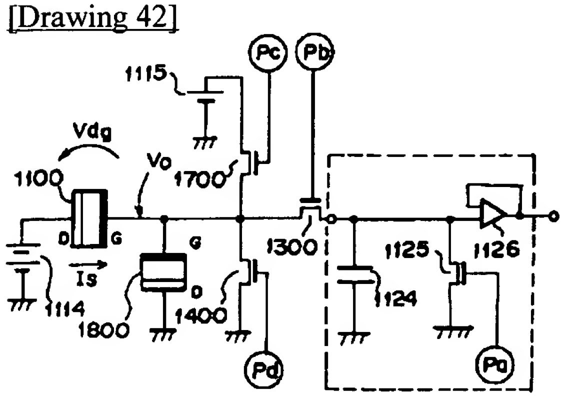

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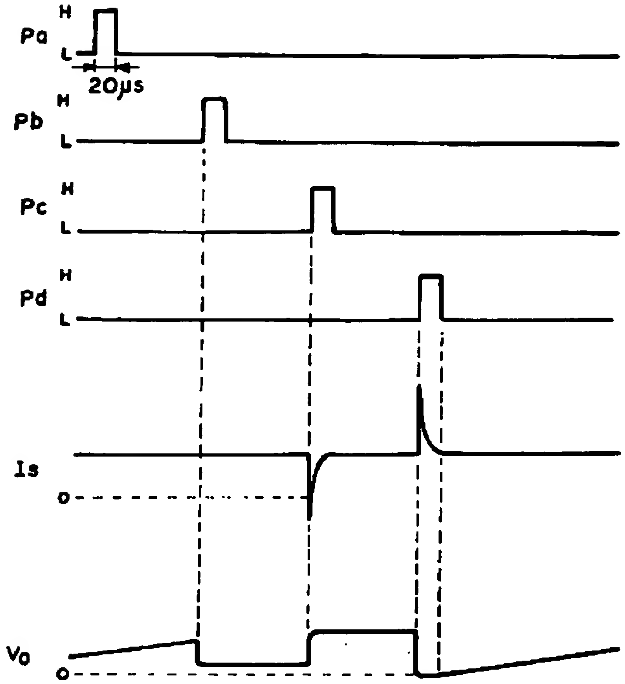

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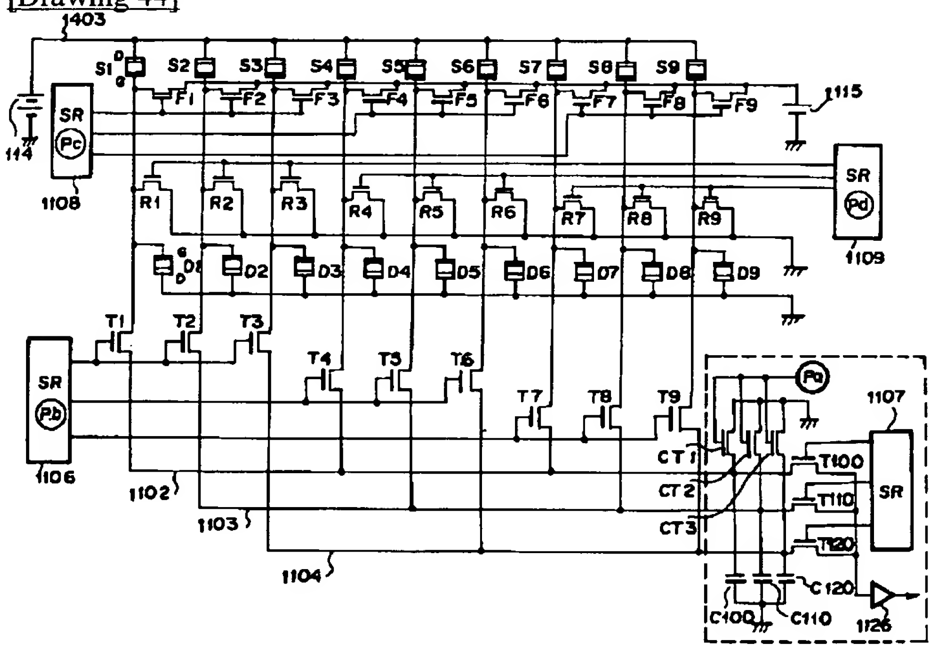

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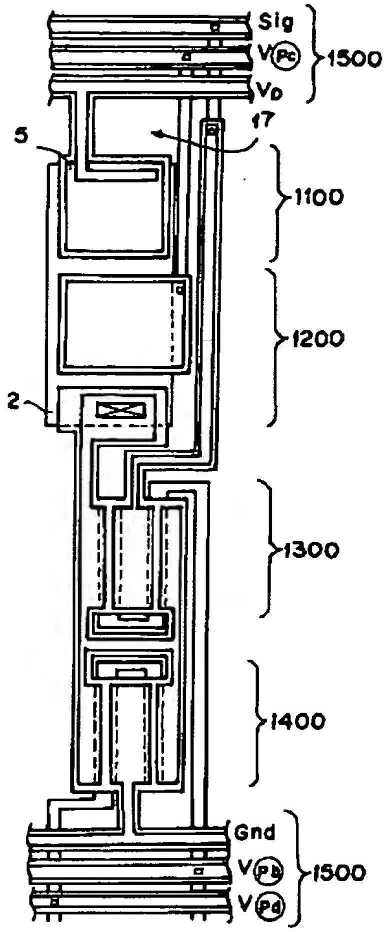

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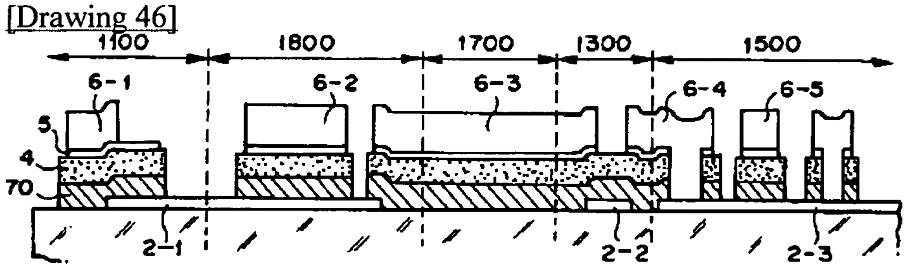

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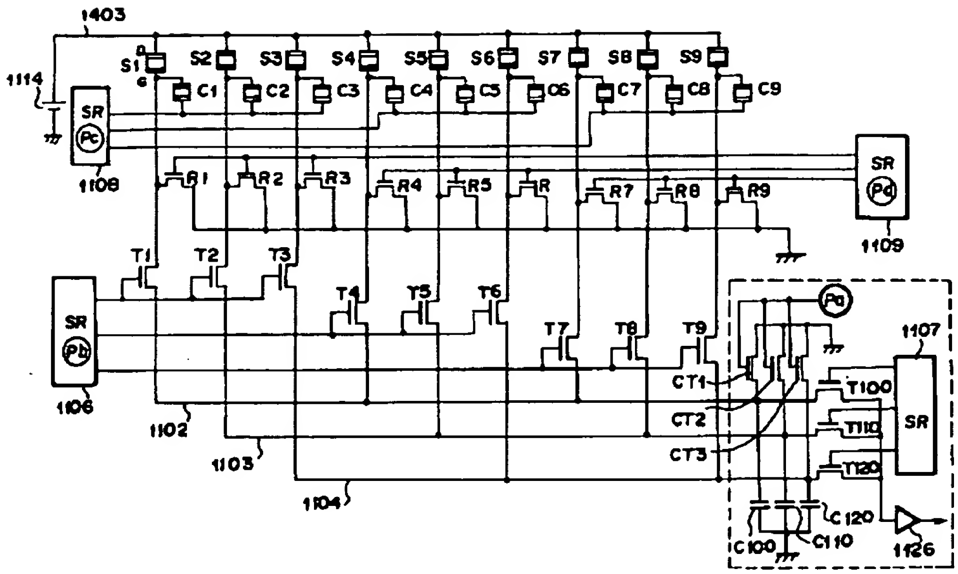

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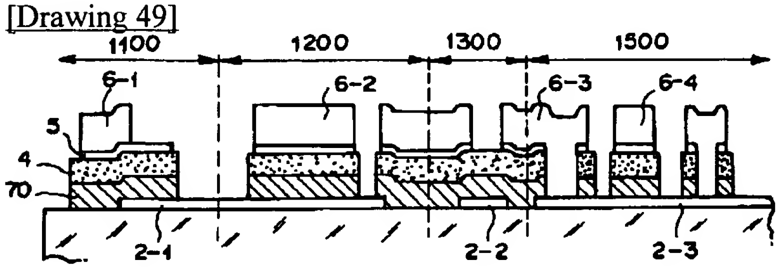

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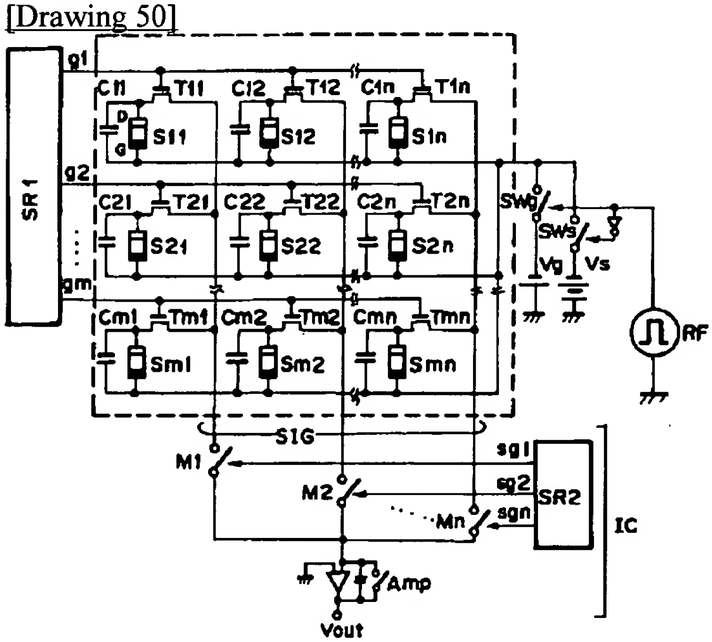

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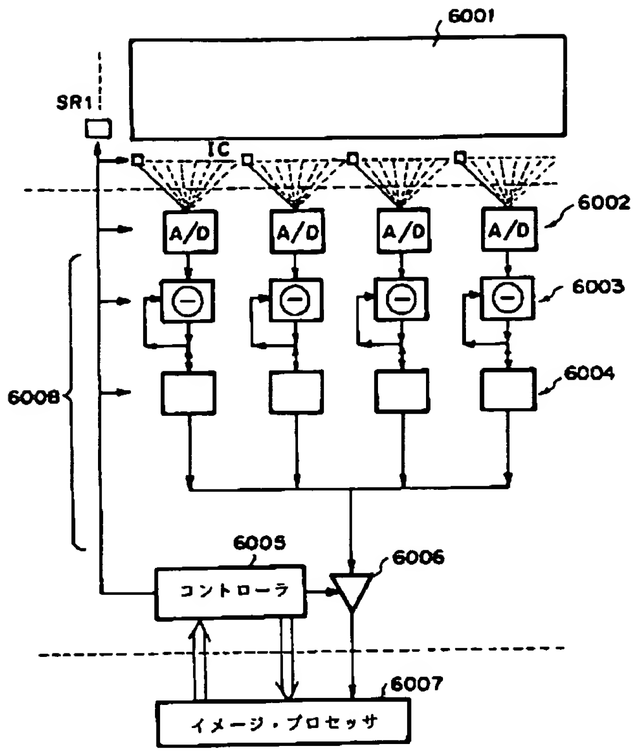

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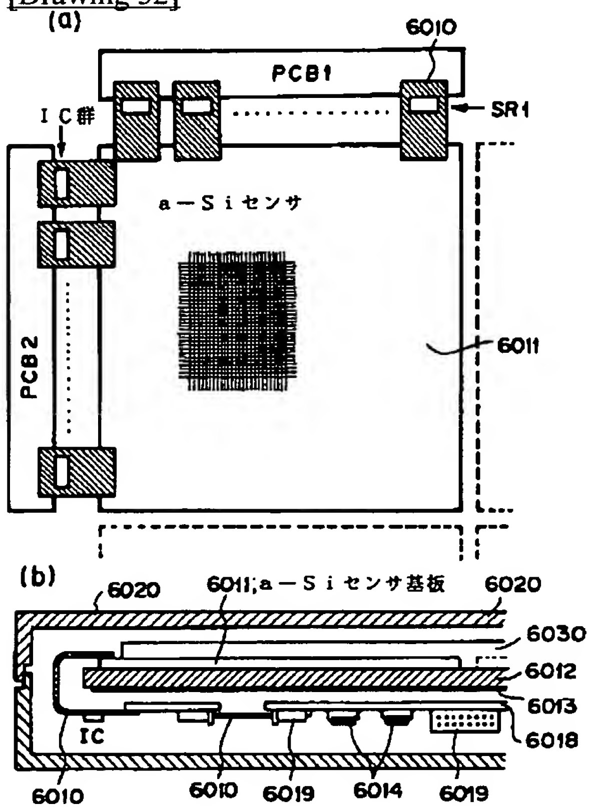

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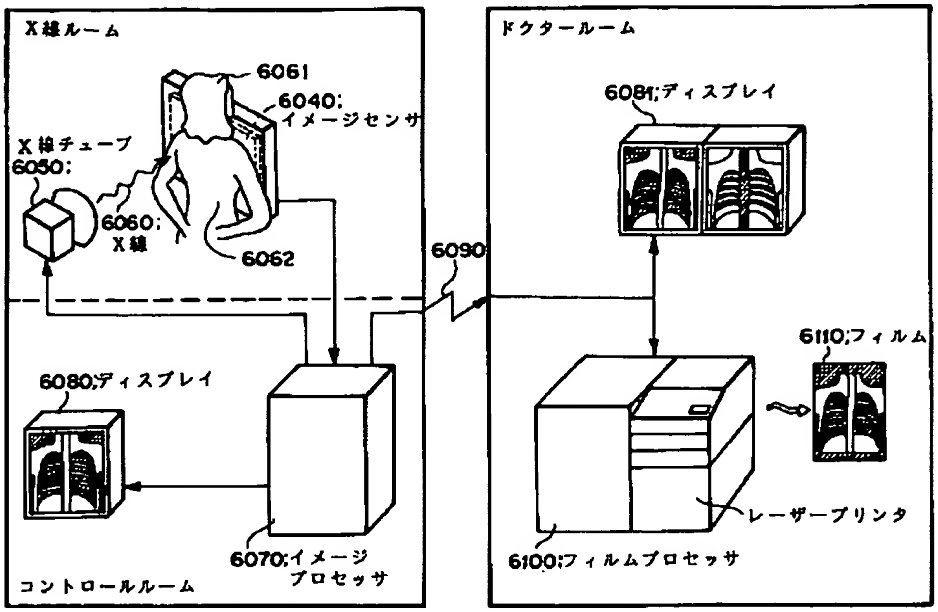

[Translation done.]

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